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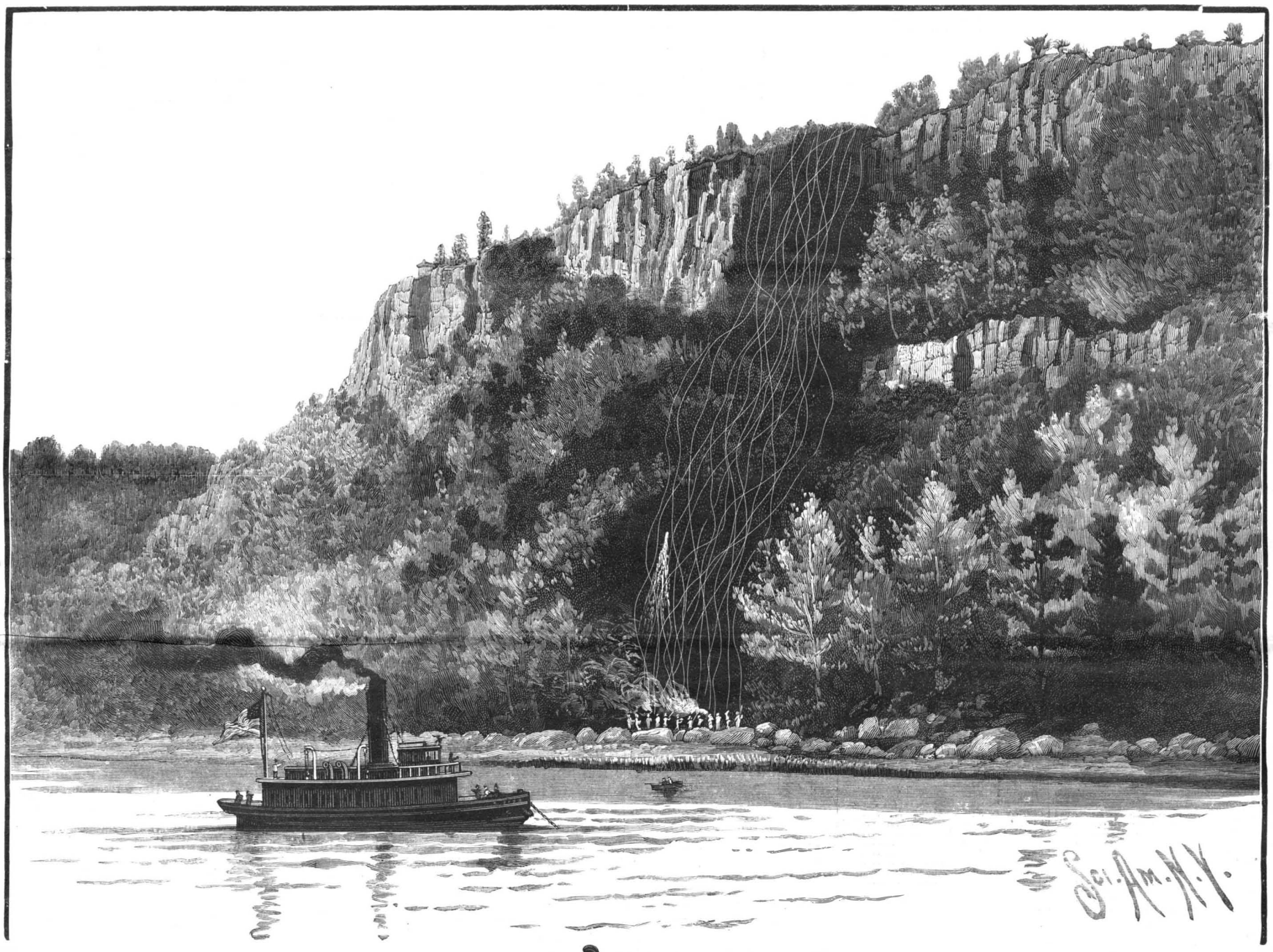

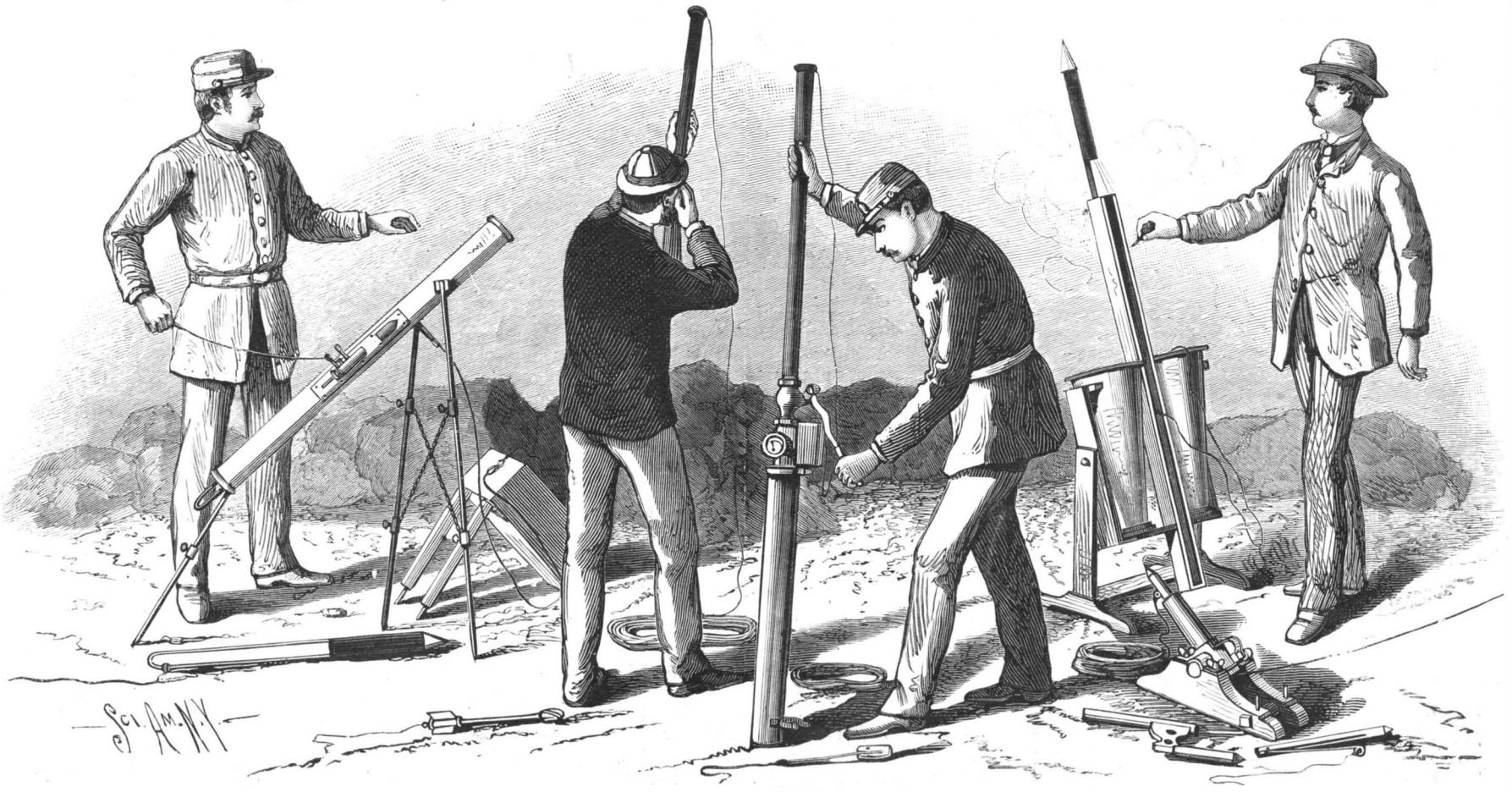

NEW YORK FIRE DEPARTMENT TESTING DEVICES FOR THROWING LIFE LINES OVER BUILDINGS.—[See page 325.]

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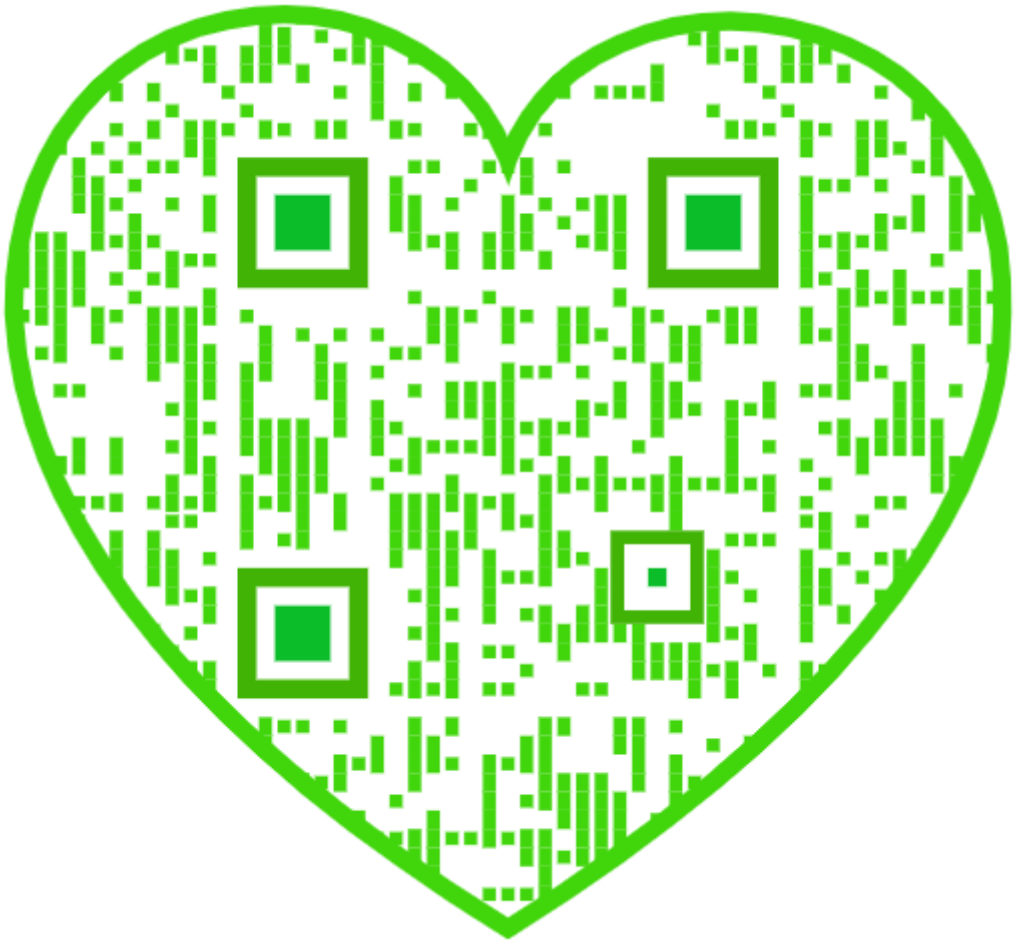

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NEW YORK, SATURDAY, MAY 23, 1885.

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COMPRESSED AIR FOR SMALL MOTORS.

A correspondent revives the idea of driving light machinery, requiring less than one horse power, by means of compressed air.

The first essential feature is the means for compressing the air, and this he proposes to accomplish by a windmill.

The air receiver he proposes to construct capable of sustaining a pressure of 3,000 pounds to the inch. Its size will depend upon the use to which it is to be put. For storing air for driving a one horse vehicle for several hours, a cylinder 4′ x 2′ would be ample.

We thus have a reservoir of force on which we can draw at will, and one which is applicable to a multitude of domestic purposes.

In the case of light vehicles, they may be constructed, let them be observed, with no less beauty than if intended to be dragged after a horse. The rear axle is made to revolve freely, and is provided with a crank at its center. Both wheels are attached rigidly to the axle, or, in order to facilitate turning, one may be left loose, according to the practice of steam fire engines. The forward axle is provided with suitable upright and handle, to direct the course of the carriage. The cylinder of compressed air, which for a light load need not exceed 3′ x 9″, is placed upon the wagon body, and will accomplish two and a half hours' propulsion, having at the end of this time a residual pressure of 500 pounds. Where the absence from the source of supply will be longer than this, two cylinders, or one of double capacity, may be used. The weight of each cylinder will be about 85 pounds, and double this weight, or if only one large one be used, somewhat less than double, will be no more than the weight of an extra person, the physician's coachman for example.

The connection of the engine, borne by the cylinder, with the axle crank is either direct or by intervening gearing. Where two cylinders are used, they are both connected with the receiver of the engine.

The advantages presented by this system over animate motors are so undeniable that eventually it must supplant them to a large extent. It is admirably adapted for daily service in a hundred different ways. Its first great virtue is the saving of the cost of maintenance. A horse is a continual bill of expense. Whether used or not, it must be daily fed and cared for; whereas our windmill requires only a very light diet of lubricant, and is docility itself. Nor is it apt to grow sick and die. Blankets, hitching straps, and whips will not be called into requisition.

In all previous traction engines, it has been necessary to provide for the great weight of a boiler and its appendages, and we have had consequently a cumbrous mass of machinery ill suited for ordinary use. With compressed air we add no more than the weight of a driver, and our wagon runs off as lightly as at present.

While we have considered only the case of light vehicles, the system is none the less applicable to heavy trucks and drays. The added weight in the latter case need not exceed 450 pounds, and this would be more than compensated for by the saving in expense and the absence of horses from our crowded streets.

There appears to be a wide field for the exercise of inventive genius in the production of compressed air motors and vehicles thereby operated.

GRAIN IN CAST IRON.

There is cast iron that is so fibrous that a turning chip of twenty feet long has been nursed from a shaft in the lathe, but this iron was of exceptional quality, and was used for the making of a steamboat shaft before forged iron shafts were common. Ordinary cast iron has no fiber—none worthy the name. It is of a granular or cellular structure, and is a conglomerate of material of which iron proper is only one portion. But iron may be so refined, by selection and mixture of ore products, as to present a structure of cells so minute as to be capable of a polish aud burnish resembling steel.

This excessive refinement is not always an improvement. A series of experiments in cast irons, comprehending the mixture of the irons, the requirements of heat and fluxes, and the quality of the fuel, shows that for ordinary purposes the reduction of the cellular structure to an approximation to homogeneity is not advantageous; for finish pieces and ornamental work, as the aprons of lathes, and for gear blanks which are to be exposed, and for similar purposes, iron that will receive a silvery luster when polished is excellent; but such iron is devoid of the quality of tension and recuperation—the more open cellular iron will yield and recover better than the closer iron.

For heavy castings, like planer beds and lathe beds, the more open iron is the better; it is less liable to come out of the mould chilled and hardened in spots, and it has a tenacity under severe strain that is not equaled by the finer iron. The mottled color of such iron after being planed sometimes troubles the machinist, who wants to make a good job out of the best materials. The writer's opinion was recently asked in regard to this matter. An eleven ton planer bed had been prepared for setting up, and the recessed V-ways showed a mottled surface—gray and black—as really good soft iron frequently does. It had been suggested that the dark cellular spots were holes where the grain of the iron had been torn out in planing—taking a rank feed for finishing chip. Of course, this was impossible, and yet the open structure of the iron, that was exposed only after the casting skin had been removed, gave the impression of a honeycomb rather than of a solid.

If this structure of the material is not the most elegant when finished, it is absolutely stronger than the closer grained qualities of iron. And it is claimed by some builders of heavy tools that wearing surfaces of such iron are more durable and run easier than those of closer grained iron—that the oil fills the cells, producing and maintaining numberless minute reservoirs of the lubricant. "What sort of a planer bed would fine machine steel make?" asked an intelligent foreman. "There would be required a barrel of oil with drip pipe at each end, as the platen moved." Probably the grain of cast iron and the uses to which it is to be put should be inseparable considerations.

THE TEETH OF MILLS.

A suggestion that the teeth of reamers could be wisely reduced from the wide flutes so common was made several months ago. Further observation is to the effect that most of the milling machine cutters have teeth too few for their diameters. In shop practice it does not appear to be the rule that the diameter of the mill has any relation to the number of its teeth—the idea appears to be that from root to point the length of a milling tool tooth should be from half an inch to one-fourth of an inch; this without any regard to the diameter of the mill, or the circumferential speed at which it was to run, or the difference of the material on which it was to act.

In a shop of considerable pretensions was noticed a workman attempting to dress a cast steel blank in the milling machine by a mill with teeth of three-eighths of an inch long—the blank being on a vertical arbor and fed up against the teeth of the mill, which was on a horizontal arbor. It was a futile attempt. The workman sprang the upright arbor, and broke out a tooth of the mill. When he was asked why he attempted the job of steel against steel with such a tool, he said that he had dressed brass blanks so the week before. So he had; but they were brass. Brass requires coarse cutters; files for brass should be coarse cut—wide teeth. But for steel the mill should have been very fine toothed.

A coarse toothed mill should revolve very rapidly, or else the feed must be very slow; whereas a fine cut mill may go slow with quite a rapid feed. If the trouble of keeping the mill clean is not taken into account, more rapid work, as well as better work, can be done by the fine tooth mill than by the coarser one. And even then there is not much saved; the workman must attend to his milling machine—it does not feed itself, however much it may run a job through unattended.

It would be well for some competent machinist to prepare a table of diameters of mills with relative sizes (numbers) of teeth, and their adaptation to the work (material) on which they were to be used. It would not be a difficult classification, and might be of great benefit.

EXPECTED ADVENT OF THE LOCUST.

According to Prof. C. V. Riley, the U. S. Entomologist, we are to experience this year a very extended appearance of the insect known as the Periodical Cicada, *alias* the "17 year locust." Prof. Riley, who has made many original observations on this insect, and who 17 years ago published an account of twenty-two distinct broods, and first announced that there is a 13 year race of the species, states that we shall witness this year the conjunction of two distinct broods, one a 17 year and the other a 13 year brood.

It is 221 years ago, or in 1664, since these two broods appeared simultaneously. The 13 year brood is located principally in the Mississippi Valley, reaching up as far as the mouth of the Missouri, and having its thickest centers in Union County, Southern Illinois, and in Kansas, Missouri, Georgia, Louisiana, Tennessee, and Mississippi.

The 17 year brood is one of the largest of all those known to occur, and will appear on Long Island in Kings and in Monroe Counties, New York, at Fall River, in the southeastern portion of Massachusetts, in parts of Vermont, and very generally in Pennsylvania, Maryland, District of Columbia, Delaware, and Virginia, also in Northwestern Ohio, in Southern Michigan, in Indiana, and Kentucky.

This curious insect, according to race, remains either for 13 or 17 years under ground, developing slowly, and sometimes burrowing far below the frost line. Prof. Riley says that they will begin to rise from the ground about the latter part of May in the more southern portion of the country and early in June in the northern portion, and that the woods will resound with the hoarse rattling noise which the males make, the females being noiseless, a fact which the Rhodian bard Xenarchus recorded in his couplet:

"Happy the Cicada lives,
Since they all have voiceless wives."

The 17 year brood that is to occur this year has been

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well recorded for the years 1715, 1732, 1749, 1766, 1783, 1800, 1817, 1834, 1851, and 1868. Prof. Riley witnessed it himself in 1868, and while the underground life of the insect has been hitherto inferred only from the periodical appearance of the perfect insect, he has since then been able to establish it by direct observation of the development of the larvæ from year to year.

Safety Against Fire in Buildings.

A meeting of the Insurance and Actuarial Society of Glasgow was held on April 8, when Mr. A. B. Dansken read a paper on "Notes on Buildings."

Having given a short summary of the various building acts in England and in America, Mr. Dansken said that the London and Liverpool acts were the models for all others in England. In Scotland they had no act really worthy of the name. In Boston and Montreal, on the other hand, the acts were of a more general nature than those in this country, though they contained some excellent provisions which might with advantage be adopted here. The Metropolitan acts contained excellent structural arrangements. Liverpool had paid great attention to regulations for the storing of goods within the boundaries of the borough, while Montreal had special regulations for the erection and use of steam boilers, furnaces, stoves, and such like. Great improvement had recently taken place in the storing of goods, particularly in London and Liverpool, and what was required in Scotland was a general building act similar in its provisions to those of London and Liverpool. The most fruitful sources of fires in dwelling house property were defective hearths and vents (flues), and this was borne out by the fire returns of various cities. The percentage in Glasgow was three times greater than in London, more than double that of Liverpool, and one-fourth more than Manchester. The reason of that, says the *Architect*, was not far to seek, for the Metropolitan Building Act required that hearths "shall be solid for a thickness of seven inches at the least beneath the upper surface of such hearth or slab;" while in Glasgow not only were there no regulations as to hearths, but the practice was to lay them on the bare wood—the most dangerous that could be adopted. Considering how gables and party walls were built in Glasgow, it was not surprising to learn that a great many fires occurred from defective chimneys. In the construction of dwelling house floors Mr. Dansken referred to the present method of deafening by filling in between the joists a layer of ashes or rubbish on loose boards, and suggested that if the space between the joists was filled in with concrete the floor would be practically fireproof. A floor of that kind immediately above shops would confine a fire, or at least retard its progress very considerably, and render the dwelling houses much safer. Were that system adopted in mansion houses, there would be fewer instances of their total destruction. Having given some hints as to how to deal with lightning rods, Mr. Dansken proceeded to refer to warehouse and shop property. As the danger from fire increased proportionally with the size of the building, he thought some legal restrictions should be placed on their limits, for the extra rates charged for large warehouses had had little or no influence in that direction. Within recent years it had become the practice to have ceilings and walls of warehouses wood lined. That very largely increased the risk of fire; but it might be remedied to some extent by having asbestos felt under the wood lining of the ceilings and the space behind the lining of the walls, and filled up at intervals with belting of cement or plaster. Dealing with fireproof iron doors, Mr. Dansken referred to several varieties, but said that he preferred one formed of a combination of corrugated iron and asbestos. With respect to the mode of hinging them, he thought that where practicable the hinges should be bolted through the full thickness of the wall, and that the steps of the doors should be raised higher than the floor level on either side, to prevent liquid flowing from one floor to another. Mr. Dansken concluded by referring to different forms of floors suitable for public buildings, in which a combination of iron and concrete was treated in various ways.

J. J. Keller.

Mr. J. J. Keller, senior member of the well known chemical house of John J. Keller & Co., of this city, died recently aged 61, the victim of a mistake in the giving of medicine. As a remedy for facial neuralgia his physician prescribed, or intended to prescribe, for him a dose equal to three-quarters of a milligramme of sulphate of atropine. By some error as yet unexplained, the dose given to the sick man was three-quarters of a gramme, or one thousand times more than had been intended. The patient took the dose, became immediately unconscious, and soon after died.

Atropine is an alkaloid obtained from the belladonna plant, or deadly nightshade. It is a very active poison, but a very excellent and wonderful medicine when rightly used. It is especially employed by oculists in treating diseases of the eye, having a remarkable effect in dilating the pupil.

The Kaolin Beds of Chester County, Pa., and of New Castle County, Del.

BY GRAHAM SPENCER.

For the last fifty years the manufacture of china in this country has been steadily growing, and is now an important industry, and one that is increasing in the quantity as well as quality of its goods yearly. The first pottery in America was established in Philadelphia, about half a century ago, by a man named Tucker, who carried on the business for some time, making very excellent semi-porcelain ware. Since then, Trenton, New Jersey, is the great point of manufacture east of, and East Liverpool, Ohio, west of the Alleghanies. Besides these, Baltimore, Wheeling Steubenville, Beaver Falls, and Cincinnati, and a number of other places have one or more potteries located in them.

The great bulk of kaolin, or china clay, used in the potteries of the United States is mined in this section. The amount of prepared clay shipped last year was nearly twenty thousand tons.

Kaolin results from the decomposition of a rock composed of feldspar and quartz; and is found in pockets or beds, in low and very often swampy ground (I speak of kaolin found in this vicinity), the clay underlying the surface soil holding the water. The amount of covering varies; in some cases being less than eight feet from the surface, and in others as much as forty. The pockets are of an oblong shape, the general direction being northeast and southwest. The kaolin is found bedded against veins of talc, which determine the width of the pocket. The talc is very irregular in its pitch, but eventually cuts the clay out. The talc is in turn bedded against partly decomposed mica schist, and very often against a vein of iron or manganese.

There are no surface indications of kaolin, and it is generally proved by boring, or sinking small shafts. After having determined the position of the deposit, the dirt is stripped off and the clay uncovered, and taken out by means of carts, cars, or derricks, as the case may be. From the situation of the pit, which is generally in the lowest ground, there is no opportunity for drainage after you are down any depth, and constant pumping becomes necessary, not only of surface water, but of large springs, which burst out from the sides of the pit and through the banks.

The clay is taken from the pit to the washing machine, which is a three or four inch shaft, according to the power you have, placed horizontally with knives at right angles, about four inches apart, made of three-inch by inch iron, twelve inches long. The whole is enclosed in a stout framework, with a pulley at one end of shaft connected by belt with main shaft, and an opening made at the other end of the machine for the escape of the clay and sand. The shaft is set in motion, a stream of water turned on, and the clay thrown in the top as fast as a man can shovel it. The sand or quartz coming out with clay and water settles in a box, where it is continually being shoveled out.

The clay, combining with water, and of the thickness of cream, is allowed to run slowly off into a number of troughs for a time, until all the impurities have had a chance to settle. It is then turned into large vats, where it remains until quite thick. It is then pumped into presses, which are a number of wooden panels held together by iron rods—each panel containing a canvas bag. The water escapes through the pores of the canvas, and leaves the clay in such a condition that it can be handled and placed on shelves in the open air to dry, after which it is ready for shipment.

Kaolin, both in a crude state and washed, is much improved by exposure. If placed in piles, and allowed to freeze and thaw during the winter, it will be found much tougher in the spring. A strong, tough clay is of much more value to the potters, as it enables them to make thinner ware. It is said that in the manufacture of the finest ware, in China, one generation mines the clay for the next to use.

The average yield of washed koalin from a ton of crude clay is from thirty to fifty per cent. I have never seen crude clay in any quantity which would yield above that.

The quartz, washed from the crude clay, is of the purest nature; and when pulverized is worth about $12.00 per ton, and is sold to the potters—they using it in the body of their ware, and also with feldspar as as a glaze.

The mica or talc which is washed from the clay, and settles in the troughs, makes a good fire brick.

In conclusion, to give a general idea of the size of the deposits of kaolin in this section, I would say that in the pit I am now working, the clay had been proved at a depth of ten to sixteen feet from the surface, for over 300 feet in length and 80 to 100 feet in breadth; and in depth 50 feet, and still clay. The greatest depth I have ever been down, in any of my pits, is ninety feet, the strata of clay continuing, but which had to be abandoned on account of the expense of keeping the dirt from caving in.

The color of kaolin varies from a pure white to a yellow (as shown in the specimens), the white being more valuable. The yellow and the white clay are often found banked against each other, and running vertically downward, side by side. The clay is hard to excavate, and requires the strongest steel pointed shovel for work, being dug in sods.—*Proc. Eng. Club.*

Cements for Special Purposes.

The value of a cement is, first, that it should become a strongly cohering medium between the substances joined; and, second, that it should withstand the action of heat, or any solvent action of water or acids. Cement often fails in regard to the last consideration. For waterproof uses several mixtures are recommended, and the following may be mentioned:

One is to mix white lead, red lead, and boiled oil, together with good size, to the consistency of putty. Another is powdered resin, 1 ounce, dissolved in 10 ounces of strong ammonia; gelatine, 5 parts; solution of acid chromate of lime, 1 part. Exposing the article to sunlight is useful for some purposes. A waterproof paste cement is said to be made by adding to hot starch paste half its weight of turpentine and a small piece of alum. As a cement lining for cisterns, powdered brick 2, quicklime 2, wood ashes 2, made into a paste, with boiled oil, is recommended.

The following are cements for steam and water joints: Ground litharge, 10 pounds; plaster of Paris, 4 pounds; yellow ocher, one-half pound; red lead, 2 pounds; hemp, cut into one-half inch lengths, one-half ounce; mixed with boiled linseed oil to the consistency of putty. White lead, 10 parts; black oxide of manganese, 3; litharge, 1; mixed with boiled linseed oil.

A cement for joints to resist great heat is made thus: Asbestos powder, made into a thick paste, with liquid silicate of soda.

For coating acid troughs, a mixture of 1 part pitch, 1 part resin, and 1 part plaster of Paris is melted, and is said to be a good cement coating.

Correspondents frequently ask for a good cement for fixing iron bars into stone in lieu of lead, and nothing better is known than a compound of equal parts of sulphur and pitch. A good cement for stoves and ranges is made of fireclay with a solution of silicate of soda. A glue to resist damp can be prepared with boiled linseed oil and ordinary glue; or by melting 1 pound of glue in 2 quarts of skimmed milk; shellac, 4 ounces; borax, 1 ounce, boiled in a little water, and concentrated by heat to paste. A cement to resist white heat may be usefully mentioned here: Pulverized clay, 4 parts; plumbago, 2; iron filings, free from oxide, 2; peroxide of manganese, 1; borax, one-half; sea salt, one-half; mix with water to thick paste, use immediately, and heat gradually to a nearly white heat.

Many of the cements used which are exposed to great heat fail from the expansion of one or more ingredients in them, and an unequal stress is produced; or the two substances united have unequal rates of expansibility or contractility; the chemical or galvanic action is important. The whole subject of cements has not received the attention it deserves from practical men. Only Portland cement has received anything like scientific notice, and a few experiments upon waterproof, heat-resisting, and other cements would show which cements are the best to use under certain circumstances. —*Van Nostrand's Magazine.*

A Russian Bath at Home.

Among the new home conveniences recently introduced, is a simple attachment to the ordinary bath tub, by which the luxury of a vapor or medicated bath may be taken in one's own house.

To persons who enjoy the luxury of the Russian bath, but do not reside where such establishments are accessible, the new vapor appliance is a good substitute.

The medicating or disinfecting materials are placed within cylindrical air chambers, and fed drop by drop into the water, and mingle with the steam as it is drawn into the bath tub. The invention has been introduced into some of our city hospitals, and a number of physicians have recommended it for its capability as a deodorizer and disinfecter. A bath may be perfumed by a few drops of any odorous extract, put into the cylinder with the other ingredients. Handsome rooms have been fitted up for exhibiting the practical workings of the new bath apparatus at No. 12 East 23d Street, New York, and persons residing out of the city who may desire to know more about the invention can gain information by addressing John Ponder, at the above place.

Heavy Electric Light Suits Coming.

The Edison Electric Light Company have commenced suits against alleged infringers on their patents for incandescent electric lighting on a scale which promises to give a large number of lawyers a fine field of labor. The various companies made defendants are the U. S. Electric Lighting Co., the U. S. Illuminating Co., the Consolidated Electric Light Co., the Swan Incandescent Electric Light Co., the Remington Electric Light Co., and the Schuyler Light Electric Co., besides a few prominent users, who, in patronizing these various companies, to this extent dispute the validity or force of the Edison patents.

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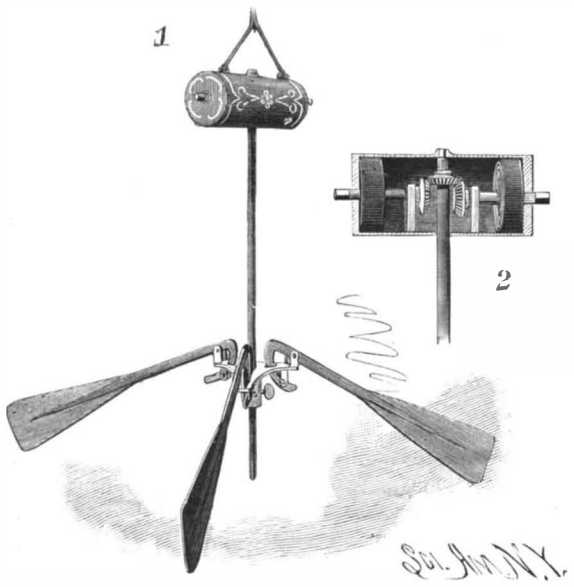
AUTOMATIC FAN.

The fan shown in the cut is suspended from the ceiling, and is for keeping flies away from the head of a person or from food placed beneath the fan. In the ends of the box, Fig. 2, are coiled springs for operating the fan from opposite sides of its shaft, thus doing away with one-sided pressure on the shaft. The inner ends of the springs are secured to spindles, each of which carries at its inner end a beveled pinion meshing with a beveled pinion on the fan shaft, which is free to slightly rise and fall in its bearings, thereby making the pinion throw its own weight as well as that of the shaft and



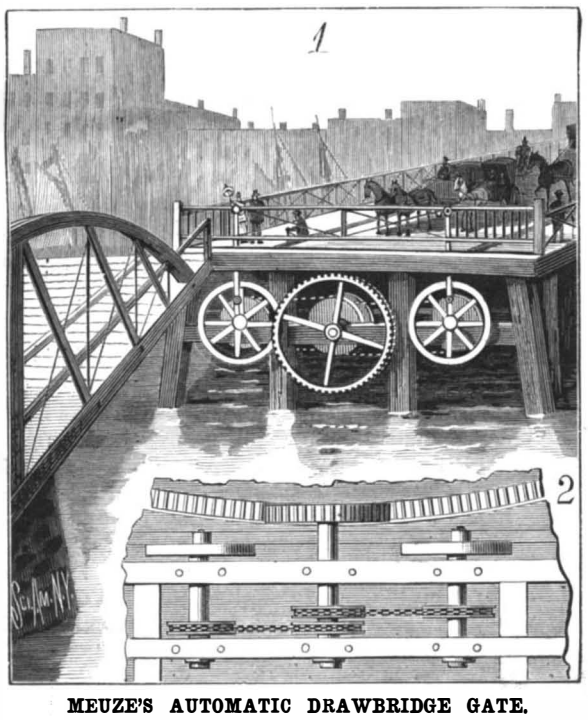
PITTMAN'S AUTOMATIC FAN.

fans on the side pinions, to give the necessary retarding action on the springs to prevent a too rapid movement of the fan. Fitted on the shaft is a sliding socket carrying the fan blades, any number of which may be used. These blades project laterally from the socket, to which their shanks are pivoted, to provide for varying the vertical working angle of the blades and to increase or decrease the length of their sweep horizontally. The ends of the shanks are formed with an arc-shaped tail piece, which, in moving the blade vertically, slides through a slotted projection of the socket provided with a set screw for holding the blade when adjusted. The fan is put in operation by winding up the springs by a key applied to either spindle.

This invention has been patented by Mr. W. H. Pittman, whose address is care of Mr. T. J. Pittman, 550 Grand Street, New York city.

AUTOMATIC DRAWBRIDGE GATE.

The gate is arranged to slide vertically on the end of the draw opening, and is attached to two connecting rods pivoted to the gate near the top, and at their lower ends to the sides of two wheels mounted on the outer ends of shafts arranged under the end of the permanent part of the bridge. On each shaft is a sprocket wheel. Between the shafts is a third, on the outer end



MEUZE'S AUTOMATIC DRAWBRIDGE GATE.

of which is rigidly mounted a cog wheel, engaging with a segmental rack on the under part of the end of the draw. On this shaft are two sprocket wheels, over which pass endless chains, also passing over the wheels on the side shafts.

When the draw swings open, the rack turns the cog wheel, and by means of the chains and side wheels the gate is raised. When the draw swings back into a position parallel with the axis of the bridge, the cog wheel is turned in the inverse direction and the gate is lowered. The gates at the ends of the draw are thus opened and closed automatically, and cannot be tampered with, as they can only be operated by the swinging draw.

This invention has been patented by Mr. F. W. Meuze, and further information can be obtained from Messrs. F. W. Meuze and C. Hahn, of 1117 Madison Street, Bay City, Mich.

The Magnesia Gas Light.

As the result of experiments carried on by a Swedish engineer, a very beautiful light is obtained by incandescence of magnesia, the great heat obtained on burning Strong's water gas sufficing for this purpose.

It appears that, so far, bituminous fuel has not been used in this plant, and those in charge of it are apparently not disposed to look with favor on the gas that would be produced when the "water gas" became mixed with hydrocarbons from the distillation of coal. It is stated that for the purpose of lighting by means of magnesia combs, the pure water gas alone is suitable, and that the light would be spoiled by admixture of common gas.

The best results are obtained by using very thin rods of magnesia, thinner than the leads in ordinary pencils. These are made by making magnesia into a paste with gum, or some such material, pressing out the little rods, and heating them to a very intense heat in crucibles in a gas furnace. They are hard and firm and of a semi-porcelain nature. A number of these are arranged in a metal holder, in double rows, like the teeth of a coarse comb, and this holder is secured over the flame obtained by burning water gas in an ordinary gas burner. After a few seconds, the magnesia rod emits a beautiful and steady white light.

Engineering says the entire works of Schultz, Knaudt & Co., at Essen, Germany, are lighted in this manner. The pipes and burners previously used for ordinary illuminating gas are now used for the water gas, each jet having one of the magnesia combs placed over it. It is stated that the lighting of the works is most excellent, as indeed a visit to the works indicates. The amount of light obtained by the above means from any ordinary sized well-made burner is truly surprising, and its steadiness leaves nothing to be desired. The arrangements for fixing the magnesia combs on to a burner are of the simplest description. The rods of magnesia are slowly consumed, one set lasting from 80 to 100 hours in use. Each comb costs, as supplied by the company ready for fixing, 5 cents, so that the cost per night for illumination is very small indeed, considering the amount of light obtained from each comb, during at least 80 hours. The gas plant at work produces from 220,000 to 250,000 cubic feet of water gas per twenty-four hours. The fuel used, as above described, yields as nearly as may be 16 cubic feet of gas per pound of fuel consumed. The cost of an apparatus of the above capacity, that is, producer, two generators, fan engine for ditto, and small boiler, with all valve gear and cooler, with gas holder of about 18,000 cubic feet capacity, or roughly speaking, equal to two hours' gas production, all ready for work, is $10,500.

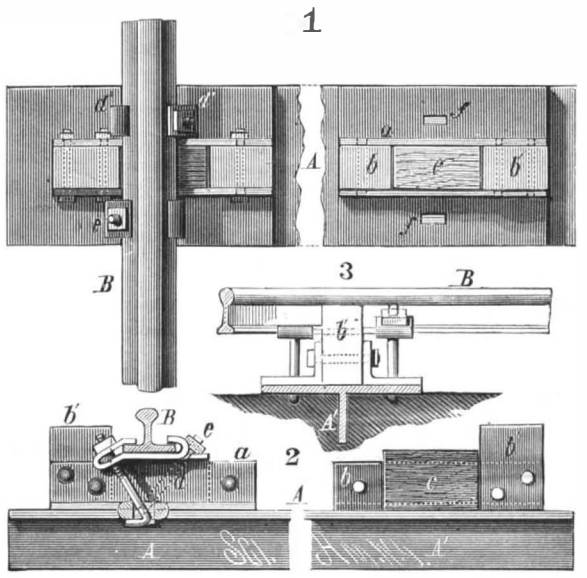
The current costs are very small, but little attendance being required. It is stated that the gas costs at the rate of 1 cent for 150 cubic feet, charging $1.25 per ton for the fuel and allowing 15 per cent on the cost of plant for interest and amortization.

Liquid Gunpowder.

One of the greatest difficulties encountered in the manufacture of gunpowder is the intimate admixture of the constituent parts, the combustion of which produces the explosion. Mr. Nordenfelt has advanced a very ingenious and novel idea, for which he has applied for letters patent. He proposes, instead of grinding together the primary substances, sulphur, charcoal, and saltpeter, in their solid state, to employ the following process instead: Sulphur, in the proper proportion, is put in solution as sulphate of carbon; this is mixed with carbonaceous matter, which in this case is not charcoal, but cotton or cellulose fiber, ground to an impalpable powder. Finally, a saturated solution of saltpeter is added to this mixture in the required proportion. There remains now nothing to be done except to evaporate under disturbed crystallization, or in vacuo, to obtain a powder the elements of which, according to the statements of the inventor, are thoroughly mixed, and, therefore, in condition to furnish the maximum useful effect. Almost a liquid gunpowder is thus obtained.

METALLIC RAILROAD TIE.

The tie herewith shown is of wrought or cast iron, and is made of considerable width to prevent its being pressed down into the roadbed. It is formed with a rib, A', along its under surface, which strengthens the tie, and entering the roadbed prevents all lateral movement. Upon the upper surface, near the ends, the tie is formed with short flanges, *a*, between which are held by bolts the blocks, *b b'*, that hold in place the blocks or cushions, *c*, of wood or other suitable material for supporting the rails, B. The blocks, *b'*, are somewhat higher than the flanges, so that they form abutments to keep the rails from spreading and to permit the rail to be raised by thin blocks of wood. The blocks, *b*, are detachably secured, so that they may be removed and the cushions taken out without disturbing the rail or tie. The rails are held in place by plates and bolts, as shown in Fig. 2. These plates are folded to clasp the base of the rail at both edges, and each plate receives but one bolt, which passes through a hole made in the fold, and is attached to the tie by the hook of the bolt entering a suitable slot in the tie, the bolts being removable by unhooking without disturbing the tie. The slots being made in line with the center of the rail, the bolts stand at an angle. The short fold in each plate is put in with a sledge at the time of laying the track. With this construction, by removing the nuts



VAN ORDEN'S METALLIC RAILROAD TIE.

from the bolts and straightening out the short folds in the plates, the rails may be removed and new ones put down without disturbing the ties.

Further particulars regarding this tie may be obtained from the inventor, Mr. Charles H. Van Orden, of Catskill, N. Y.

A NOVEL SOAP HOLDER.

The handle of the soap holder is formed by the doubled end of a wire, the lower end of which is bent at one side and then upward to receive a flanged thimble. The frame receiving the soap box is formed of a wire bent double, twisted in its upper portion and entered into a tube on the handle wire; its lower portion is firmly locked to the thimble, which turns with the frame on the lower end of the handle wire. The soap box, Figs. 2 and 3, is made of wire cloth, and has a flanged band of sheet metal around its edge, through which the twisted wires pass. On the flange of the band is a cover, notched to allow it to pass projections on the band when it is to be removed, and held in place at other times by the projections. On the straight portion of the wire is a sliding nut fitting the twisted portion. By moving this nut up and down while the device is held in hand by the handle, the soap box is caused to rotate rapidly in alternate directions. The currents and agitation of the water thus created are most effective in dissolving the soap and carrying out the dissolved portion.

BRYANT'S NOVEL SOAP HOLDER.

This invention has been patented by Mr. Charles A. Bryant, P. O. box 61, Wakefield, Mass.

ICE cold water sprinkled upon cabbage plants infested by the imported cabbage worm is claimed to be sure death to that insect. The water should be sprinkled upon the cabbages during the heat of the day, when the worms will roll off and die. The discovery of the remedy is credited to Mr. Charles H. Erwin, of Painted Post, N. Y., and is communicated to the *Rural New-Yorker* by Prof. C. V. Riley.

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IMPROVED STEAM HAMMER.

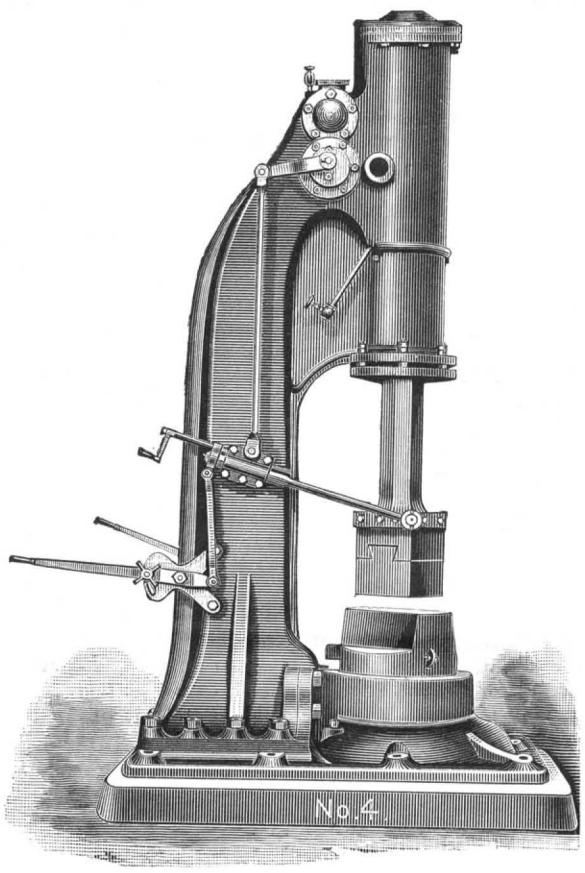
The many advantages resulting from the use of steam hammers, not only in the forming of large pieces in rolling mills and forges, but in the every day work of the smith's shop, are most generally recognized; by their use a saving is effected in time, fuel, and material, the amount of labor is reduced, and, most important of all, the character of the work is improved. The wide adoption of hammers of this kind has been the outcome mainly of their durability, their simplicity of construction, reliability in operation, the rapidity of the blows, and the ease with which the force and number of blows may be regulated.

The improved steam hammer shown in the accompanying engraving, being of small cost, has removed the great obstacle to the introduction of the steam hammer in the ordinary smith's shop. It is of very simple construction, having single column standard with bed plate and cylinder cast in one piece. As will be seen from the cut, it is very strongly and compactly built, and is easy to manage. All the moving parts are so proportioned as to reduce the wear to a minimum, and any necessary repairs can be easily made. It is self-acting, taking steam at both ends of the cylinder, and in all of the sizes manufactured a square blow is delivered. Either of the sizes will strike a heavy or light blow as required, and can be worked either single or double acting, the change being quickly effected and without trouble.

The small sizes of this hammer will work up old car axles, the product being especially applicable for connecting rods, eccentric rods, and other parts of machinery which require iron of the best quality. They will also work up old scrap, quantities of which are always to be found in the blacksmith shop, and which produces one of the best irons for ordinary purposes.

Size No. 4, shown in the illustration, was constructed with a view to furnish at a moderate price a hammer that would forge large and heavy cranks and shafts, and the frames and bearings connected with locomotives, not only with expedition, but with the greatest accuracy and saving of labor; and it is claimed that twice the number of locomotive frames and bearings can be turned out in the same time that would be required with appliances hitherto employed for doing the same work. With a heating furnace it will work up scrap into billets for making car axles, crank shafts, and all heavy forgings which formerly required large and expensive hammers to accomplish.

In this size the cylinders are 12 inches in diameter and the stroke 27 inches. The piston and die weigh 1,500 pounds, and the whole weight of the hammer is 14,000 pounds. A blow of upward of 10,000 pounds



BELL'S IMPROVED STEAM HAMMER.

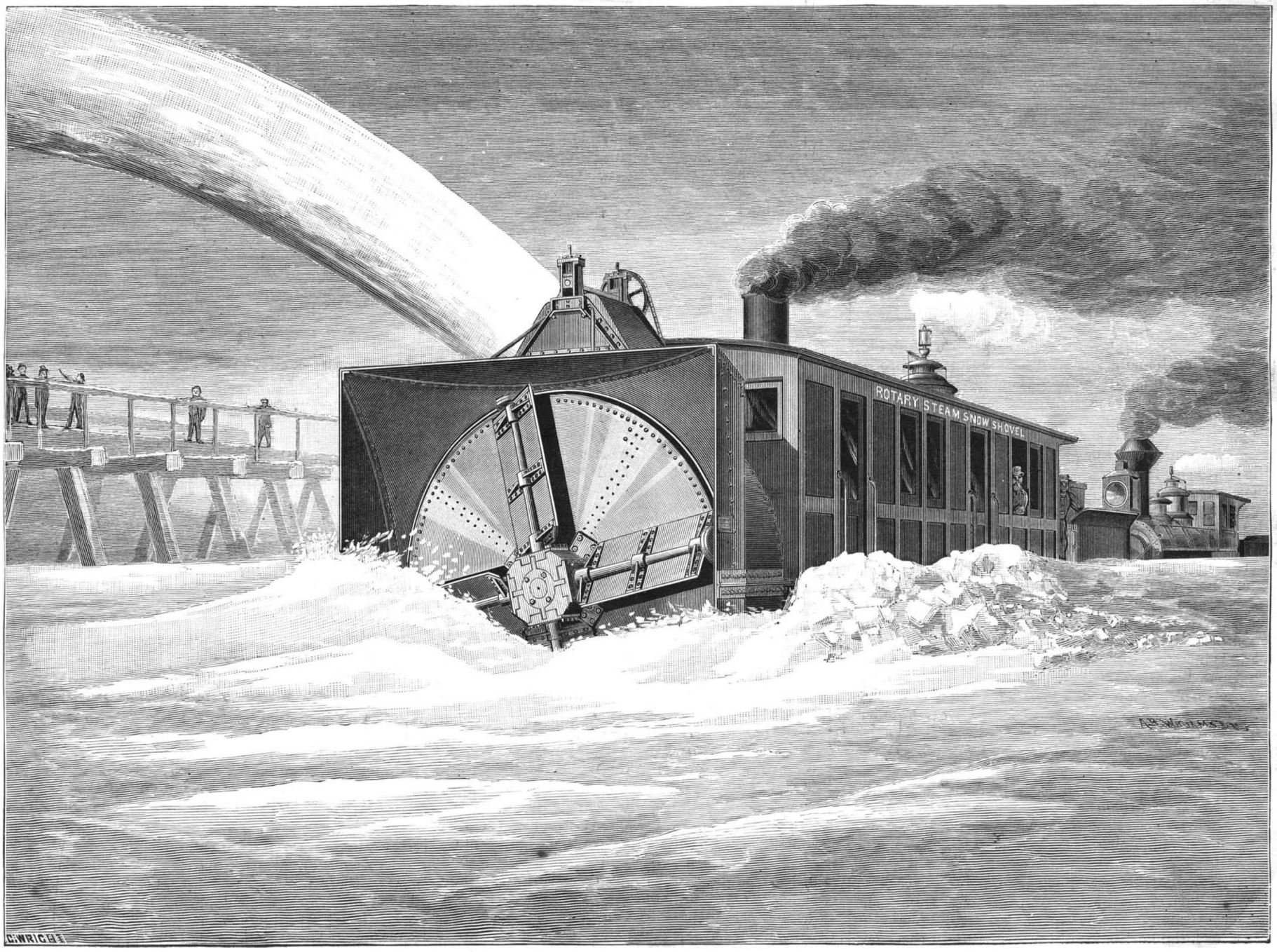
may be struck, and the rate may be 100 blows per minute. A shaft 9 inches in diameter can be beaten out at a single heat.

The manufacturer of this steam hammer, Mr. David Bell, of Buffalo, N. Y., who will furnish all further information, has received many letters of commendation from those who have used and tested the hammers.

A MAMMOTH STEAM SNOW SHOVEL.

On March 28th last, a shovel designed by Mr. E. Leslie, superintendent of the Rotary Steam Snow Shovel Manufacturing Company, of 203 East 16th St., this city, and built by the Cooke Locomotive and Machine Company, of Paterson, N. J., was tested on the tracks of the Buffalo Creek Railroad at Buffalo. N. Y. The track selected for the trial had been covered with snow all winter, and being near the Lake front there were no obstructions to break the force of the wind snow storms; the snow was from 2 to 6 feet deep, compact and solid, and was more or less mixed with sand blown in from the beach of Lake Erie. The test, although undoubtedly as severe a one as the machine could have been put to, was most successful, as the shovel cut a clean channel, and threw the snow from 100 to 300 feet from the track. The performance of the shovel is well illustrated by the accompanying engraving, made from an instantaneous photograph.

The knife wheel and shovels (or fan wheel) are driven by two cylinders, 17 inches diameter by 22 inches stroke. The boiler is of locomotive type and is 50 inches diameter, with a fire box 69 inches long, 34 inches wide, 66 inches deep. There are 165 flues, 2 inches diameter and 11 feet 2 inches long. The total heating surface is 1,030 square feet. Boiler and engines are fastened to the main frame of heavy I iron, 12 inches deep, 5 inches wide, the front end of which receives the bed plate and pillow block castings carrying the fan wheel and knife wheel shafts, and at right angles to the latter the engine shafts. The front bed plate casting with main pillow block extends the whole width of the outside frame, which is 9 feet 6 inches. It is well ribbed, to enable it to receive the six gussets of ½ inch steel plates which carry the drum, and to which latter the gussets are fastened by means of 3½ inch by 3½ inch by ½ inch double angle irons. The drum is otherwise well braced to the frame to enable it to bear all the strains and shocks which might occur in going through deep drifts. The face wheel shaft is hollow, and the shaft of the knife wheel revolves within it. The space between the babbitted bearings is used as a receptacle for oil, which will last for a considerable length of time. The solid shaft, after passing through the hollow shaft for some distance, rests at the back end in a thrust bearing, to provide against the fore-and-aft thrust of the knife wheel. The motion of the knife wheel and fan wheel is transferred from the engines by means of beveled gears, one gear on the hollow



A MAMMOTH STEAM SNOW SHOVEL.

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shaft and one on the solid shaft gearing each into both of the gears of the separate engine shafts, so that one engine must run in the opposite direction from the other engine. There is a slight difference in the diameter of the gear wheels, the wheels on the engine shafts being the largest, having 40 teeth of 3½ inch pitch, and those of the fan wheel and knife wheel 33 teeth; therefore, while the engine shaft makes 175 revolutions, the knife and fan wheels will make 200 revolutions, each in opposite directions.

The arrangement for reversing the knives for the purpose of cutting the snow from either the right or left is somewhat difficult to explain without drawings. There are four knives, consisting of one-half inch steel plate, 40 inches long and 24 inches wide. They swing on the knife arms, which extend from a square wrought iron hub to a bearing fastened to an angle iron at the circumference of the wheel, which is 8 feet 9½ inches diameter. The space between the knives is occupied by plates of steel, five-sixteenths inch thick, forming sectors of a circle. They are fastened to the angle iron on the circumference, and radially to four other spokes of wrought steel between the knife arms. The knives are held in a position forming an angle of about 30° with the sector plates, leaving openings of about 12 inches between the edges of the knives and the edges of the plates. At the end of the knives next to the hub the bearings have attached to them gear segments, which again gear into others, each of the latter having one strong bevel wheel tooth attached, which projects over the end of the square hub next to the end of the fan-wheel shaft, but does not come in contact with the latter. The end of the fan-wheel shaft next to the square hub of the knife wheel forms a hub, and is provided with a deep annular groove to receive a ring, 4 inches wide, with four bevel wheel teeth, corresponding to the teeth of the second segment gear of the square hub. The bevel wheel ring can slide in and out on the central part of the fan-wheel hub a distance of 3 inches, and may thus be engaged with the four segments of the square hub, or may be disengaged after the work of reversing the knives, which is done automatically, has been performed. The first gear segments are each provided with two notches, corresponding to the two positions of the knives, and a four-winged clutch latches into those notches, holding the knives in proper position. The clutch may be disengaged by sliding it parallel with the axis of the shaft, which is done simultaneously with the sliding of the bevel wheel ring, bringing the latter to gear with the second segment gears, and, the knives being free, they will swing over to the other cutting position when the bevel wheel ring is allowed to return. After this work of reversing the knives has been performed, the ring and clutch fly back, the clutch fastening the knives again, and the ring in the same instant disengaging the gears. The clutch has four rods attached, passing through the square hub, and connected to a sleeve back of the hub. Springs in the hub keep it in proper place. The bevel wheel ring also connects by means of rods to a sleeve around the hollow shaft, and springs keep it disengaged from the gears. Two rods behind the fan-wheel hub pass outside the shaft through the pillow block, and are attached to a ring-shaped plate on the shaft, to which a spring latch arrangement is attached, so that when the ring-shaped plate is forced forward by means of a lever combination at a certain position of knife and fan wheel, the clutch and bevel wheel ring are both moved forward. The engines are then slowly reversed, and the latch on the hollow shaft disengages at the proper place, fastens the knives, and disengages the gears, and the shovel is ready to do its work again in the opposite direction.

The opening of the spout can also be changed so as to cast the snow on the proper side corresponding to the motion of the fan wheel. The spout starts from the circumference on the top of the drum with an opening of 6 ft. Part of the sheet on each side forming the circumference of the drum leads off tangentially at an angle of about 50°; so that if such sheet from each side were continued to the vertical center line, the vertex of an angle would be formed there, but the sheets being cut off, they leave an opening of about 42 inches measured horizontally. In order to form an opening on either side of the center line of the drum, a cap or plate is introduced which swings at the vertex, forming there a bearing on each side of the wheels, which incase the opening fore and aft. This plate continues at the same angle as the sheets from the drum, and rests on the latter. The shaft on the top of the cap plate running across from sheet to sheet extends beyond the back sheet to receive a chain wheel, and a chain runs from there below to a pinion, to the shaft of which a hand wheel is attached by which the cap may be changed to either side of the spout. A pawl with ratchet wheel on the pinion shaft keeps the cap in its position. There is also an arrangement attached to the bearings of the cap shaft by which the cap may be raised or lowered in the center for the purpose of changing the angle. At an angle of 50°, and at 200 revolutions of the fan wheel, the horizontal distance thrown (if the snow is well enough packed) would be about 248 ft. and the vertical height about 74 ft. At the trial near Buffalo the number of revolutions was not noted, but the distance thrown was reported to be 295 ft., and from this it is calculated that the fan wheel must have made at least 210 revolutions. To avoid any danger of throwing the whole machine from the track in case of ice having formed inside the rails, an ice breaker is attached in front of the forward wheels of the front truck. This ice breaker consists of two strong pieces of steel inside in the shape of a large planing tool, projecting about 2 in. below the tops of the rails, and placed inside them. They are attached to a frame which swings on the axle, and may be raised, when required, from the inside of the house. There is also a flanger attached in rear of the back wheels of the forward trucks, to remove the snow remaining on and betweeen the rails and not taken away by the shovel. The attachment is made in the same manner as the ice breaker. It may also be raised when necessary. A steam brake is attached to the wheels of the rear truck.

The principal dimensions of the machine are as follows:

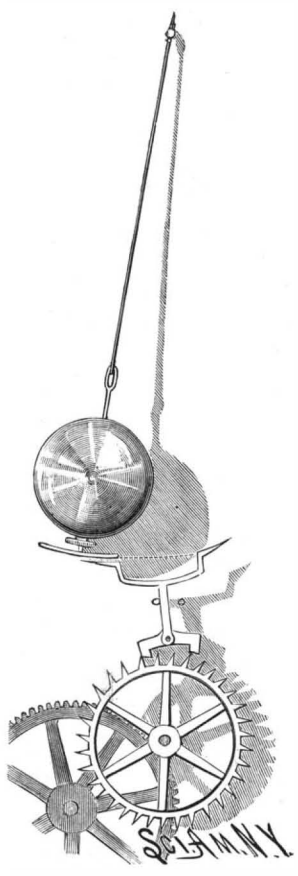
Distance apart of centers of trucks	16 ft. 8 in.
Center of front truck to back of drum	3 " 11 "
Extreme length of drum	5 " 1 "
Extreme length of frame from back of drum	29 " 1 "
Extreme length of machine	34 " 2 "
Height of machine to top of spout	12 " 8 "
Width of house	9 " 6 "
Length of body of house	28 " 4 "
Length of roof of house	31 " 6 "

Weight of entire machine, about 45 tons.

Among those present at the test were several railroad officials, who strongly indorsed the work done by the machine, and expressed their conviction that any railroad subject to snow blockades could be kept open in the most severe storms by the use of these shovels, thereby causing a great saving in rolling stock, and preventing delays.

PENDULUM ESCAPEMENT.

The construction and operation of the pendulum escapement recently patented by Mr. William Hart, of Kirksville, Mo., will be readily understood from the accompanying engraving. The improvement consists simply in applying power through a lever escapement to a pendulum. The pendulum, being detached, meets with less resistance after receiving an impulse, and hence is more accurate for time. The power being applied at or below the ball instead of so far above and so near its place of suspension, much less power is required to keep it in motion, or to run the clock.



Less power being required, there is, naturally, less wear; and a reduction in springs, weights, and material may be made throughout. Weaker or thinner springs being sufficient, there is less liability of their breaking. The dial of the clock is brought down where it can be squarely seen, and no ladder is required in winding. In tower clocks the pendulum may be made of any desired length, and run up into the steeple out of the way. An accurate compensation may be had by extending a rod from the bottom of the ball up, for the support of the pendulum.

Stepping Stones to Success.

Learn your business thoroughly.

Keep at one thing—in nowise change.

Always be in haste, but never in a hurry.

Observe system in all you do and undertake.

Whatever is worth doing at all is worth doing well.

One to-day is worth two to-morrows.

Be self-reliant; do not take too much advice, but rather depend on yourself.

Never fail to keep your appointments, nor to be punctual to the minute.

Never be idle, but keep your hands or mind usefully employed except when sleeping.

Use charity with all; be ever generous in thought and deed—help others along life's thorny path.

Make no haste to be rich; remember that small and steady gains give competency and tranquillity of mind.

He that ascends a ladder must take the lowest round. All who are above were once below.

Think all you speak; but speak not all you think;
Thoughts are your own; your words are so no more—
Where Wisdom steers, wind cannot make you sink;
Lips never err when she does keep the door.

—*Selected.*

New Electric Tramcar.

A public and very successful trial on the lines of the South London Tramway Company of an electrically driven tramcar was lately made, which is thus described by *Engineering:* The propelling power was furnished by secondary batteries manufactured by the Electric Power Storage Company, and the motors and gear were constructed to the designs of Mr. A. Reckenzaun, whose name is intimately associated in England with the utilization of electric accumulators for the purposes of locomotion, both by land and water. The car which figured in the trial trip has already been running at night on Queen's Road, Battersea, for six weeks past, in order to subject its machinery to a prolonged trial, and previously to that it was tested for a very considerable time at Millwall upon a line 400 ft. long, with inclines varying from 1 in 17 to 1 in 40, and with a curve of 35 ft. radius.

The trial trip was made under the command of Mr. Reckenzaun, and was undertaken to give the Local Board of Wandsworth an opportunity of seeing the performance of the car before granting their permission for its use within their district. Thirty passengers were carried, and the full rate of speed allowed, namely, six miles an hour, was easily maintained even uphill, very considerable inclines being easily mounted. The car proved to be under complete control, and could be stopped and started as readily as a horse car. The machinery ran perfectly silent, and an inside passenger had no evidence that there was anything unusual in the vehicle, except from the interest manifested by the people on the footpaths, and occasionally by the behavior of a too intelligent horse, who seemed inclined to resent this invasion of the vested interests his race possess in street traction. The car carries under the seats sixty accumulators weighing 40 lb. each, and capable of propelling it, with a load of 46 passengers, over an average country for two hours. The cells can be run out at the end of the car and replaced by fresh ones in a few moments. The current is utilized in two Reckenzaun motors, each mounted on a four-wheeled bogie frame, and driving one of the axles direct by means of a worm and wormwheel. The worms are very quick pitched, so that the wheels can drive them when the car is running downhill, or traveling by momentum only. The wormwheels dip into oil baths.

All the connections are taken to main switches on the driver's platform. Each switch handle has three positions; in the first the circuit is broken, in the second the current passes through the two motors in series, and in the third the motors are connected up parallel to each other. In the second position a current of 30 amperes flows from the battery, and in the third a current of 100 amperes. This latter position is used when starting the car from rest, or when on inclines, and the second during general working. The total weight of the car and machinery is 4¼ tons, made up as follows: Car, 2½ tons; accumulators, 1¼ tons; motors and gear, ½ ton. The working expenses fortraction, including interest and depreciation, are estimated at 3½d. per car mile, or one-half of horse traction.

Electric Motor Trial.

The Daft Electric Light Company are building some motors for testing the merits of their invention in a practical manner on some of our railroads. The *Electric Record* records the fact that two motors are being built for the Baltimore Union Passenger Railway Company, and one for the trial on the Ninth Avenue Elevated, New York city. On both roads work is rapidly being pushed. On the latter the portion chosen for the trial lies between Fourteenth and Fifty-fourth streets, a distance of two miles. As both uptown and downtown tracks will be equipped, there is needed four miles of center rail, This is a 30 foot, 56 pound standard rail. A portion, however, is laid with a smaller rail, 50 pounds to the yard. It has already been hoisted the entire length, and now only the laying is needed for completion. The rail is specially insulated with Mr. Daft's patent umbrella-like insulators, four of which are placed to each rail. Already the laying is finished from Fourteenth to Thirty-fourth street, on the uptown track. The trackmen finding it a little novel at first, slow progress was made. Its completion will be noted within about 10 days or a fortnight. It is proposed to use the two center rails parallel for the outgoing current and the four outer or regular rails for the return current. By this means the calculated resistance of such a system is very slight indeed. The framework of the motor is completed, and now only the work of assembling is need to finish it. Its estimated weight is about seven tons. On Sixteenth street, in an old sugar house—No. 428—one of Mr. Wright's 150 horse power stationary engines and the dynamos will be placed. The foundations are nearly completed, and within a few weeks the primary station will be in readiness.

Thousands of miles, the writer says, have been traveled by these motors, and heavy machinery has been driven for fifteen months or more, thousands of feet from the primal source of energy. The result of the experiments about to be made will go far toward solving the practical and financial problem of utilizing electricity for propelling purposes.

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UNEXPLORED BRANCH OF THE FIRE ESCAPE PROBLEM.

It would seem as if the subject of fire escapes had been thoroughly explored in all its branches when we look at the various contrivances which ornament the walls of many of the buildings in this city, when we remember the appliances placed at the disposal of tenants by the aid of which they can make their own descent, and when we see the machines for reaching, from the ground, those caught within a burning building. Permanent fire escapes, while admirably answering the purpose, cannot be placed upon every building in a great city, neither can they be located so as to be within access of all the windows; a fire in the line of the escape practically cuts off all the adjoining windows, and though such a case is extremely rare, it comes within the range of those possibilities which should be carefully eliminated when dealing with this problem. People will not, and cannot be compelled to keep private fire escapes —mainly ropes or chains and flexible ladders and tubes —within easy reach. They know the advantage of having a rope handy in case of fire, but they do not feel the necessity, since they have never been taught by actual experience—the only school that will vividly impress upon people's minds a dread of fire, and will make them take proper precautions. Machines operated from the ground—the most common kind being the several forms of extension ladders—are impracticable in this city, mainly because of the telegraph wires, the strength and great number of which in almost every street effectually prevent raising the ladders. With this obstacle removed we would still have the time necessarily consumed by them in reaching the fire.

Since the burning of the SCIENTIFIC AMERICAN offices in January, 1882, the Fire Department of this city has been looking for some device by means of which any person caught in the upper stories of a burning building could be rescued. To further this idea, about one year ago inventors of appliances for throwing a cord or small line over the roof or into any selected window of a building were invited to exhibit their machines to the authorities. Recently a second test was made at the foot of the Palisades, as shown in our frontispiece. The object of these trials is to obtain an apparatus which will, without fail, raise a small cord to the roof of the highest building in this city, and if it will carry a line into any particular window, so much the better. Of course, the cord once over the cornice of the building, it is easy for those on the ground to bring it within reach of an individual in one of the upper windows, when a heavy or life line, attached to it, may be raised.

The appliances shown in the lower view used powder to throw rockets, to throw projectiles from a cannon or rifle, and compressed air to throw a projectile. To the lower end of each missile was attached the end of a cord which played out as the missile rose in the air. No device was presented using an elastic substance, such as metallic springs, wood, or rubber.

Mr. Benj. F. Morris, of Hook and Ladder Company 15, exhibited a device for throwing a rocket, consisting of a brass barrel 3½ feet long, and having a bore large enough to easily admit the rocket, and mounted upon extension tripod legs, two pivoted a short distance back from the muzzle, and one pivoted to the rear extremity; by this means the device could be rapidly adjusted so as to discharge the rocket at any desired elevation. The rocket was fired by a cap placed at a point about in the middle of the barrel.

Mr. R. MacDonald, of 109 Liberty Street, showed a rifle having a bore about 2 inches in diameter, and rifled. The head of the missile, which somewhat resembled a winged dart, was spirally grooved, the shaft was of small size, and the tail was provided with side wings and with circular disks closely fitting the bore. A small charge of gunpowder was used. The rifle was rested against the shoulder and aimed, as shown in the second figure in the engraving.

The air gun, shown in the central figure, was designed by Mr. Otto Regl, of the Fire Department Repair Shops. The lower portion of the gun formed the air reservoir. and was provided at its upper end with a pressure gauge indicating up to 300 pounds. A channel led from the upper end to a rubber cushioned valve, the stem of which projected a short distance beyond the exterior. Screwing into the upper side of the valve was a barrel, which, when not in use, was strapped to the side of the reservoir. Pivoted by a catch pin in jaws placed just above the end of the valve stem was a curved lever. When the gun is not in use, this lever is so pivoted that the stem enters a concave part of the curve, and the handle may be pressed down close to the cylinder without opening the valve. When the gun is to be used, the position of the lever is reversed, so that a slight downward movement of the handle brings the convex part of the curve in contact with the stem, which is pushed in, thereby opening the valve and allowing the compressed air to rush into the barrel. The projectile was conical in shape at its forward end, and was hollow at the rear; across the hollow portion extended a bar, to which was pivoted a short rod which rested snugly in a groove cut in the side of the projectile. The string was secured to the end of this rod, and passed out at the muzzle. The reservoir is charged by a pump, and at 300 pounds will throw three shots. It is provided with a coupling by which, if the air should give out when the gun is needed, it could be connected with the ordinary extinguishers carried by the hook and ladder trucks, the pressure in which would be amply sufficient.

Mr. Francis J. Gray, of Engine House 18, showed a contrivance for discharging a rocket. Placed between two inverted conical-shaped cord holders was a wooden trough to hold the rocket. The frame carrying the holders and groove was pivoted between two standards projecting from the base; this arrangement permitted the elevation to be changed as desired. In all the rocket throwing devices a short length of wire was placed next the rocket, the cord being attached to the free end of the wire.

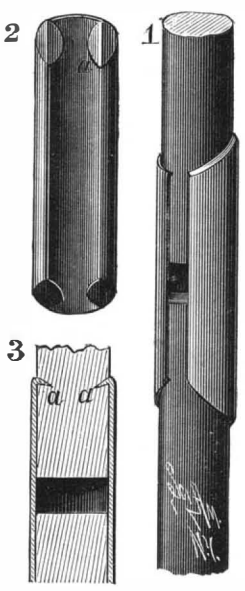
The cannon was shown by Mr. Patrick Ryan, of Engine House 25. The projectile was long, extending a little beyond the muzzle when in the gun. A longitudinal recess extended from the rear end nearly to the front of the projectile. Closely fitted within this groove was a bar, the rear end of which was pivoted, and the forward end formed with an eye, in which the cord was tied. When the projectile left the gun, the bar swung around and assumed a position parallel with the forward portion. The sighting device is shown beside the gun. One rod of the sight fitted the bore of the gun, and the sight was taken along the other rod, which by means of the connecting piece was a short distance above the gun barrel.

With these devices, which we have so briefly described, lines varying from 200 to nearly 700 feet in length were extended up the face of the cliff. None of them failed.

As near as we can ascertain, the Fire Department is in search of a device which must be of the simplest construction, must be easy to handle and control, must be unaffected by the weather, must be of comparatively light weight, and must be absolutely reliable in operation under all conditions. It must be able to easily raise a line to the roof of the highest buildings, and it ought to be capable of being aimed so as to surely reach a window at any elevation. Although New York city has taken the initiative in this branch of the fire escape problem, such a device, if acceptable here, would be quickly appreciated in every city of any size. The problem has been proposed; it now awaits solution.

BELT FASTENER.

The invention herewith illustrated, lately patented by Mr. Lewis W. Herrick, of Edmore, Mich., belongs to that class of belt fasteners formed of a piece of sheet metal having inwardly projecting teeth on its ends, which are forced into the ends of the belt by dies. The fastening clip, Fig. 2, is made in tubular form, with one side left open to allow of the insertion of the belt. The ends of the clip are inclined from the closed side toward the open side, and the edges of these portions are bent toward the center of the clip to form penetrating projections, *a*. The purpose of rounding the edges is to allow the ends of the belt while being inserted or withdrawn to slightly spring the projections apart, to allow of the easy entrance or withdrawal of the belt ends without the use of tools of any kind. When the end of the belt is being inserted, it will first bear against the outer rounded part of the projections, then ride up the incline until it strikes against the closed side of the clip. It will be seen that both ends are so secured that any strain put on the belt will only tend to force the ends of the belt further up the inclined projections. There will be no tendency of the belt ends to come out of the open side of the clip, and the strain will not tend to force the sides of the clip apart.



An Assyrian Statue of 850 B. C.

About twenty-five years ago there was shipped to a gentleman in Philadelphia, from a missionary to Syria, a life size statue of a king, taken from the ruins of Nineveh at the time of Sir Henry Layard's explorations. It had been lost by a caravan in the desert, and when received was stored and neglected, until a few days since. It represents a king clad in royal robes, bearing in one hand a basket and in the other a fir cone, a portion of the stone being covered with sharply cut hieroglyphics, which Assyrian scholars are now endeavoring to translate. The statue came from the temple of King Assur-nazir-pal, a famous conqueror who reigned from 883 to 859 B. C., and who was, therefore, sleeping in his grave when Nebuchadnezzar, King of Babylon, was yet an infant.

Correspondence.

Mr. A. R. Bennett's Improved Voltaic Cell.

To the Editor of the Scientific American:

My attention has been called to the article entitled "A Cheap Battery," in your issue of April 11, which describes the voltaic cell invented by me.

The battery is now extensively used in this country, especially for telephone transmitter work. Some telephone exchange systems use no other. The experience thus gained has led to the improvement of the battery in some respects, especially in regard to the form of the zinc plate. Such a plate as is depicted in your illustration is liable to be quickly eaten through at the water line, whether the cell works or not. Zinc rods are subject to the same destructive action when they are partly in and partly out of the solution. The zinc is now placed entirely under the surface of the solution, and a brass wire, covered with rubber tubing, brought up from it for the purpose of forming the connection. This wire is soldered into a deep hole drilled in the zinc. The tubing is then slipped down the wire until it reaches the bottom of the hole, which is then filled up with melted sulphur. When this is properly done, the zinc is eaten away only in proportion to the work performed by the battery. The zinc should always be amalgamated. The rubber should cover the wire well beyond the surface of the solution. The solution should be always caustic potash, as caustic soda creeps up and makes a very dirty cell. When the battery is intended for permanent work, the outer pot should be of cast iron. This is no better electrically, but lapped and soldered pots are not trustworthy for a long period. For long continued use the porous pot should not be less than 6x3½ inches, and the charge should be 6 ounces of caustic potash. The battery may be made to give a much stronger current—equal to 2 volts—by mixing 1 ounce of permanganate of potash with the iron borings, and filling them up with the caustic potash solution. It should be noted that unless permanganate of potash is used, no caustic potash solution is put with the borings, except what filters through the porous pot.

A. R. BENNETT.

Glasgow, April 28, 1885.

Popular Errors Concerning Health.

Professor George H. Rohe, of the College of Physicians and Surgeons, Baltimore, in a recent lecture on "Some Popular Errors Concerning Health and its Preservation," quoted the saying, "One man's meat is another's poison," and showed that, while idiosyncrasies with regard to certain articles of food or medicines do exist, they are far less frequent than is generally believed. Articles of food which ordinarily disagree may be better borne if differently cooked. A more serious error is that one should rise from the table hungry. The sensation of hunger is a cry of the tissues for food, and should always be appeased. Much of the ill-health of brain workers is due to a lack of sufficient food. It is impossible to lay down hard rules as to the quantity of food one should eat, but the remarks of the old country doctor who had lived in good health, doing hard work until fourscore and ten, might be taken as examples: "I have always eaten when I wanted to eat, as much as I wanted, and the best food I could get." Another fallacy is, that all diseases are due to disturbances of digestion. Graham bread, oatmeal, cracked wheat, etc., are more difficult of digestion than pure wheat bread.

It is a dangerous error to withhold cold drinks from persons sick with fever. It is cruel, objectless, and the dangers that are said to follow it are imaginary. The effects of alcohol upon the body were discussed at some length, and the conclusion drawn that alcohol does not supply heat to the body, but rather withdraws it. The greatest danger to the man who gets dead drunk in cold weather is that he may freeze to death. The use of alcoholic drinks in health is injurious, but its medicinal use is valuable in many instances. The notion that we should not bathe while overheated is as unreasonable as it is widespread, but persons should not remain in the bath long enough to become chilled. The traditional axiom that boils are an evidence of good health is a snare and a delusion. Prof. Rohe said: "For my own part, I should prefer to be without that sort of health. Even Job, when suffering from an abundant crop, could not gain consolation from his would-be comforters."

That vaccination does not prevent smallpox is a very dangerous error, but that it is preventive of other diseases is equally a fallacy. Statistics prove that before the introduction of vaccination deaths annually from smallpox numbered nearly 3,000 for every million inhabitants. Since the practice has become general the percentage of deaths has fallen to about one-tenth of the former number. Without vaccination the deaths from smallpox in this country would be 150,000 a year. Vaccination has not increased other diseases. That any one remedy is a cure for all diseases that afflict humanity is an absurdity. While hydropathy and electropathy are unquestionably of benefit in some diseases, they cannot be relied upon for the cure of all.

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LABOR-SAVING MACHINES FOR RESTAURANTS.

In the accompanying engravings (for which we are indebted to *La Nature*) are represented two labor-saving machines, invented by Mr. Eugene Daguin, and used in one of the largest restaurants in Paris. The first (Fig. 1) is a machine for washing dishes automatically. It consists of a circular tank divided into two compartments, so as to form on one side a vessel of boiling hot water, and, on the other, one of running cold water. The machine is provided with eight supports or artificial hands for holding the dishes to be washed. These supports revolve around a central axis, and, through the intermedium of wheels, run over an undulating track. By this means the dirty dish, as it passes through the hot water, is given a motion that helps to remove the melted grease. The plate is finally thoroughly cleaned by the action of two brushes, between which it passes, and which rub it vigorously upon the top, bottom, and edges. After this it emerges from the hot water, and dips into cold water which is continuously renewed. Here it is given the same motions as in the hot water, and finally emerges and presents itself to the right hand of the operator, who has only to remove it and place it in a drainer, from whence it is taken by the wiper.

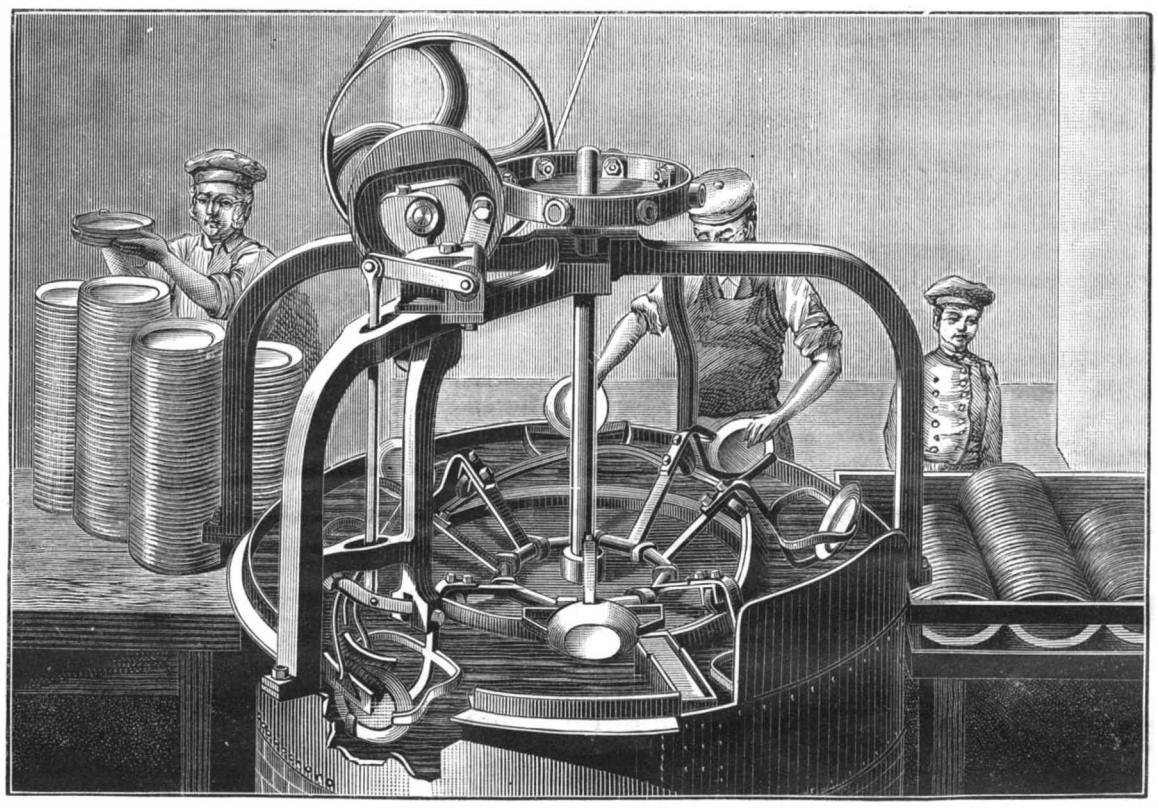

Fig. 1.—MACHINE FOR WASHING DISHES.

One of the features of this machine is its compact and simple construction. It contains not a gearing through which an inexperienced person could be harmed. It is easily cleaned, and the supports can be turned up when the machine is not in use, so that the vessels of boiling and cold water can be used for other purposes.

The other machine (Fig. 2) is designed for washing bottles. The city water is led into the reservoirs, A and B (Fig. 3). The former of these supplies the water for the outside, and the latter for the inside of the bottles. The engine gives the bottle a rotary speed of 300 revolutions per minute. Every part of the bottle passes 180 times over fixed brushes, which clean it externally and internally with cold water. The waste water falls into the receptacle, C, whence it flows out through the aperture, D.

The motive power that actuates the machine, which is very distant from the gas motor, is a small Gramme dynamo of type No. 3.

The machine is easily taken apart, and when the brushes are worn out they can be replaced without difficulty. The internal brushes which rub the bottle on every part—on the sides as well as the bottom—are mounted upon a semi-flexible rubber rod. The external brushes are held vertically against the bottle.

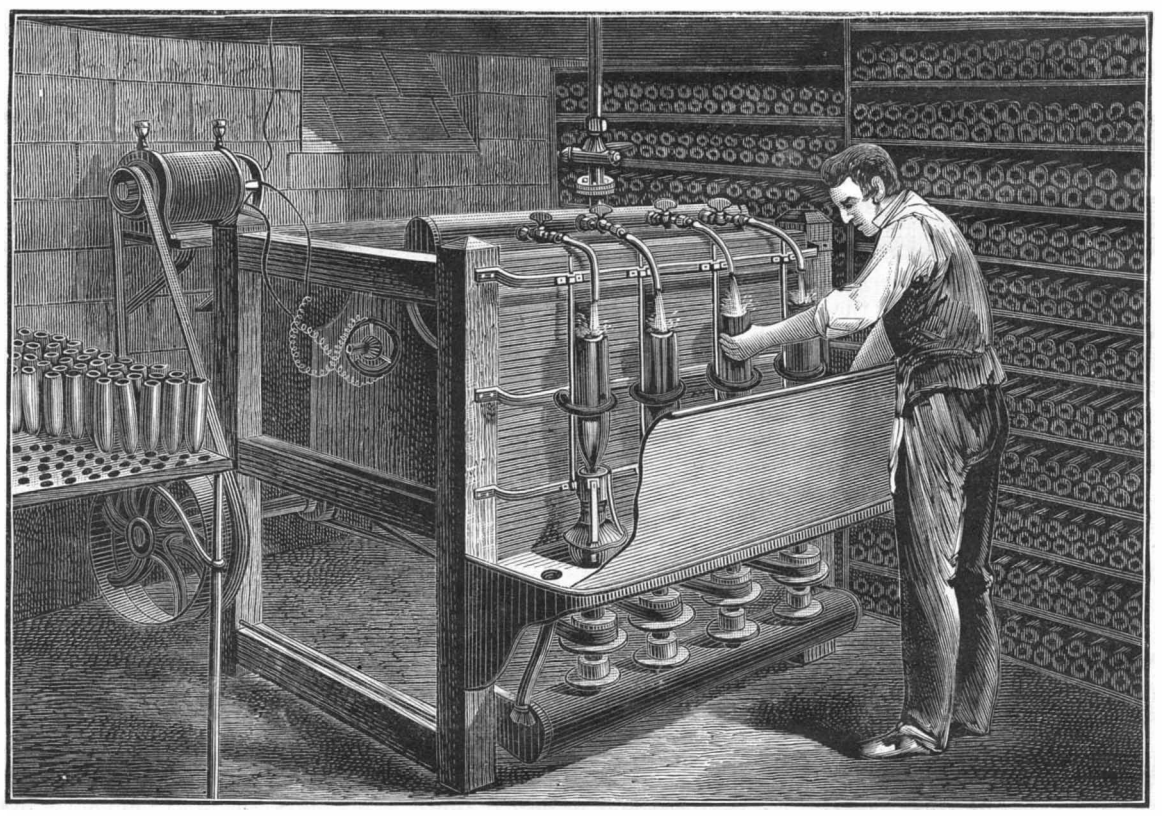

Fig. 2.—MACHINE FOR WASHING BOTTLES.

A Chance for American Sugar Machinery.

A New Orleans correspondent, long a resident of one of the Antilles, writes us as to the want of energy of American houses in improving what he considers most excellent opportunities for extending trade among these small but extremely fertile islands. He states that in Martinique alone there are thirty-two sugar refineries, using French and English machinery, one built at a cost of $1,200,000, and the others at prices varying from $600,000 to $1,000,000, the largest with a capacity of forty tons of sugar and sixteen barrels of molasses per day. Our correspondent compares this efficiency with that of American machinery in use in Louisiana, where he states that one plant recently put in operation yields 40 tons of sugar and 52 barrels of molasses per day, while its whole cost was only $62,000. The comparative excess of molasses is due to the less ripe and rich sugar cane here as compared with that of the West Indies. It would certainly seem that here was an opportunity for American manufacturers of sugar making machinery.

Alaska.

Four expeditions have been sent to Alaska within two years, and have succeeded in giving us a knowledge of the magnitude and possibilities of that once despised possession, which is inspiring lofty dreams of national and private wealth. Its fisheries have returned the government an interest of nearly five per cent a year on the $7,200,000 which Secretary Seward paid Russia for Alaska in 1867, as a delicate acknowledgment of our gratitude for that nation's firm friendship during the rebellion, and now it is found that the possession which we then did not want especially contains vast rivers, mountains, forests, and mines of undreamed of riches. Private companies are contemplating the exploration of the country; there are rumors that they are already being carried on in secret and for dishonest purposes; while a fifth government expedition is nearly ready to sail from San Francisco under the command of Lieut. George M. Stoney.

This young officer has already headed two expeditions to Alaska. He was one of the Rodgers party, who after the burning of that steamer were greatly aided in their retreat southward by the Tschoutche Indians of Alaska. The government sent him back in 1883 with presents for these Indians, and while with them he heard of a great river that emptied itself into Hotham Inlet, south of the Yukon. With two men and a dingey and ten days' provisions he explored it fifty miles, and found it could be navigated by large steamers for that distance. Last year he explored the river—named Putnam River, in honor of the young officer of the Rodgers who was lost on the ice near Siberia—for nearly 400 miles, and the present expedition is to continue the work. The river, he thinks, will rank among the great rivers of the world; numerous streams flow into it, and it is surrounded by dense forests of spruce and pine and birch, and by a general richness of vegetation unlooked for in so high a latitude.

The Putnam is not so great a river, however, as the Yukon, which Lieut. Schwatka explored in 1883 for 1,800 miles. He crossed the country 150 miles from Sitka in May, to the headwaters of the Yukon, where he built a raft and floated down the stream, through marshes, deep lakes, and great canons, where the water sometimes rushed for five miles between huge basaltic cliffs. The Yukon "is so long," says Lieut. Schwatka, "that if its source were at Salt Lake, its waters might empty into New York Bay, and its mouth is so wide that New York would be on one side and Philadelphia on the other." Another expedition, under Lieut. Abercrombie, attempted last summer to explore the Copper River, which is from 400 to 500 miles long, but did not penetrate it far.

Of the wisdom and utility of these explorations there can be no question. Alaska is not ice-bound the year through; steamers can get to Point Barrow, the northernmost land, at almost any time, and sailing vessels can reach it in ordinary summer weather. We know the country almost for its fisheries alone; its immense and almost inexhaustible tracts of timber are scarcely touched, and its mineral wealth is almost a matter of speculation. The research should be exhaustive and more distinctly scientific than it has been; and it is preeminently a government work—*Globe-Democrat.*

Underground Electrical Conduits.

The Electric Underground Conduit Company have recently exhibited a new system of conduits in which each wire passes through a separate paper tube, a quarter of an inch in diameter. This tubing is surrounded by double layers of silvered paper to prevent interference from induction, and supported by perforated partitions in wooden boxes. The surrounding space is filled with an insulating asphaltum compound. Each wire terminates at the stations in a separate binding screw, thus forming an independent connection throughout the entire system. This construction presents a decided advantage in case of accident, or where several companies use the same conduit.

AN experienced foreman, who has an eye for philosophy, says that tools apparently partake of the temper of those who use them. A short grained man has nicked bits; the impetuous man, broken ones; the lazy man, dull ones; the careless man, badly dressed ones; the man with one idea, one dress for all kinds of work; the soft man can rarely keep the edge of a tool from turning, while the good natured and even tempered man has the best tools in the shop, and is pestered continually by ill-tempered workmen who come to borrow from him whenever they have a particular piece of work to do. It is quite interesting to note the similarity in the temper of workmen and their tools.

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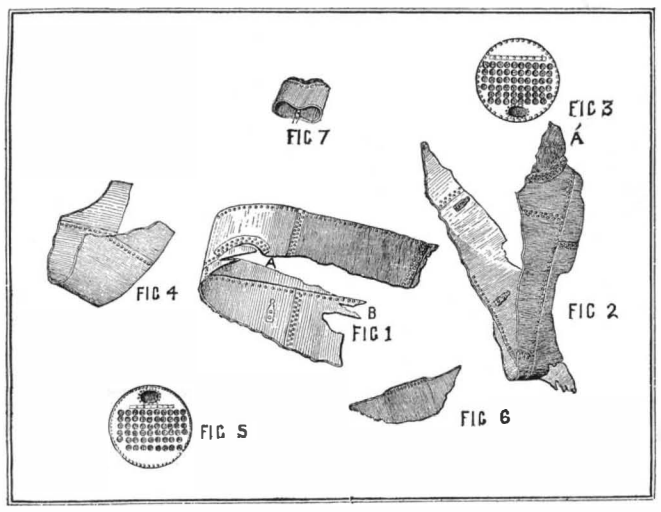
BOILER EXPLOSION AT FRANKLIN, IND.

To the Editor of the Scientific American:

Accompanying sketches show details of boiler which exploded at Franklin, Ind., on the morning of February 12. The boiler was used at a flour mill owned by Messrs. McDaniels & Wright; it had been put in new about a year ago; it was a horizontal tubular, 5 feet in diameter and 16 feet long, containing sixty-two 3½ inch tubes. It had a steam dome, about 40 inches in diameter and 24 inches high, riveted on at the second sheet (taking in part of the third sheet) with a double row of rivets. The boiler was set on a stand at the rear, the front resting on the cast iron front. The



BOILER EXPLOSION AT FRANKLIN IND.

tubes are not shown, as they were scattered in all directions, and their being shown would not aid in a correct understanding of the accident.

The initial point of rupture was at the dome, shown at A' A', Figs. 1 and 2, passing round the line of rivets, and then through the sheet and through the rivet holes of the first ring of plates, Fig. 4; at the heads the dome was blown away nearly intact, as were both the heads, Figs. 3 and 5.

By cutting out (in paper) the pieces, Figs. 1 and 2, placing the latter against the former at A' and B, and twisting them into a cylinder, the shape of the boiler is obtained; by adding the portions shown in Figs. 4 and 6, the whole boiler is obtained, and it shows that the rent commenced at the dome, and tore apart like the paring of an apple. If this had occurred under a pressure of water, there would have been no further damage after the pressure was relieved; but in the case of steam contained in a boiler, with the usual amount of water, say at 80 pounds pressure, the conditions are altogether different. Water boils at 212° in an open vessel; the temperature of steam at 80 pounds pressure is 312°. Now suppose, as in this case, a rupture takes place, the whole volume of water remaining in the boiler endeavors to form into steam, because it seeks to get down from 312° to 212°; and in that effort the 100° makes steam. It is this sudden change in the normal conditions which causes the total destruction of the boiler, and of course when it starts the rupture follows the easiest direction, and a crack from the edge of a rivet hole into a sheet would start the crack through the sheet.

The plan view accompanying shows the position of the mill and the direction in which the portions were thrown; by comparison with the other sheet each portion can be identified.

A boiler of this size should have been set in the brickwork on rollers, the boiler being provided with brackets for the purpose, and very likely the additional strain caused by the mode of setting had a good deal to do with weakening the seams of the boiler. The iron was stamped Coaldale I. Co., Pena., C. H. No. 1. A. R. P.

A NUGGET of gold weighing 21 pounds (about $5,000) has been found at the Berlin diggings, Victoria, and brought into Dunolly by two miners. The gold field was celebrated for nuggets some years since, and the present find will no doubt lead to the discovery of others.

TARPON FISHING WITH ROD AND REEL.

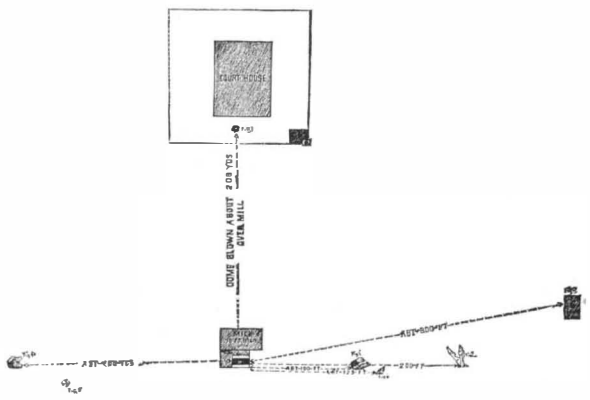
Mr. W. H. Wood, of this city, has demonstrated the fact that it is feasible to take and kill with ordinary rod and reel the mighty tarpon of Florida, by capturing one weighing 117 pounds, which we show in the accompanying sketch. For the past two years quite a discussion has taken place in some of the newspapers between anglers as to the possibility of taking the tarpon with ordinary tackle, which so interested Mr. Wood that, finding during the month of March last he had the leisure to spare, he ordered the following outfit made and started for Punta Rassa, Florida, where he made his headquarters. He had a reel made of rubber and white metal to hold 1,200 feet of twenty-one thread line, without gearing, had a square handle, and was 5⅛ inches in diameter and $2\frac{3}{16}$ inches wide in the clear. Two strong bamboo rods, each 5 feet long, and a gaff hook mounted on an ash hoe handle, also formed part of the equipment. The hooks used were large cod 0, baited with mullet tied on with fine copper wire.

Mr. Wood thus describes the capture of his first fish: "We caught sight of the back fin of a tarpon lying within two feet of the bushes, and as we were running slowly toward him I saw another some fifty feet out from the mangroves. I told my man to stop the skiff, and I then cast my bait (which consisted of the side of a mullet cut in the same manner as a menhaden bait is cut, and put on the hook in the same way and wired on) to within five or six feet of the mouth of the tarpon, which was lying still at the time. I cast out the bait near his head, and he whirled, making toward it, in taking which he was obliged to show his tail out of water, which was shoal, and as he was taking the bait I drew out from my reel through the tip some fifteen to twenty feet of extra line. After getting the bait he moved slowly away, taking the slack line, and just the instant the slack was all taken up, I drew and hooked him, when he came instantaneously entirely out of the water, trying to shake out the bait; then the trouble began.

We paddled after him, and he racing and leaping until he had made six leaps and had run say half a mile, when I found I was tiring him out, as he could not then leap entirely out of the water. After getting him pretty well tired out I suggested gaffing him, but my man thought he might knock the skiff to pieces, so we awaited the arrival of the sail boat, when I stepped out of the skiff into the boat, and reeled the fish toward me, and when he got within reach Mr. Smith gaffed him through the gills in a splendid manner, and almost with the same movement drew him into the sail boat. The feat was accomplished. A tarpon had been caught with a twenty-one thread line on a five foot bamboo rod and the large tarpon reel (owing to following him with the skiff), not having out at any time more than 250 feet of line. The time was 26½ minutes from the moment the fish made his first leap to the time we placed him back in the skiff a minute after he was drawn on board. The tarpon was 5 feet 9 inches long, and weighed 93 pounds."

The following is the score made by Mr. Wood during his trip:

No.	Length.	Weight.	Time catching.
1	5 ft. 9 in.	93 pounds.	26½ minutes.
2	5 " 7 "	81 "	21½ "
3	6 "	111 "	33 "
4	5 " 11 "	105 "	5 "
5	6 " 1 "	117 "	45 "

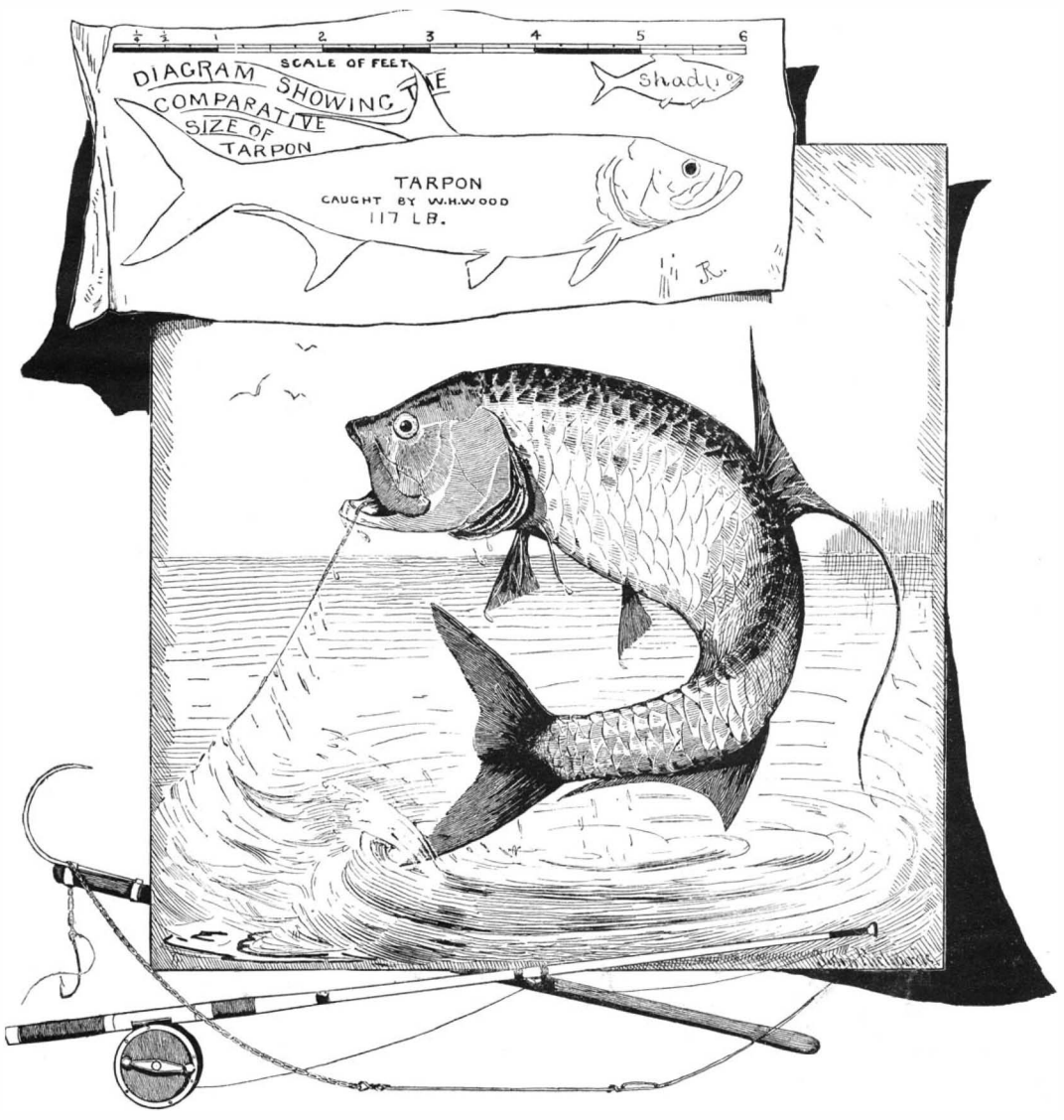


BOILER EXPLOSION AT FRANKLIN IND.

This would make an average weight of over one hundred and one pounds.

Mr. Wood describes the violent manner in which the tarpon shakes its head in leaping as something wonderful, and thinks that fish No. 4, which took but five minutes to land, broke its vertebra in one of its early aerial flights, as the fish was nearly if not quite dead when brought to gaff. The flesh of this fish is a delicate rosy tint, and is said to be quite savory.

Mr. Wood considers the tarpon the coming king of all game for sporting fishermen. His taking the still bait, his response to being hooked by immediately leaping out of the water, his swift running between leaps, his beautiful shape and superb metallic luster, added to his magnificent proportions, make him a delight to the sporting fisherman who captures him.



TARPON FISHING WITH ROD AND REEL.

Cost of Gas and Electricity in New York.

Stephen McCormick, Secretary of the Gas Commission, has reported to the city of New York regarding the relative cost of gas and electricity for lighting streets. The city has 647 electric lights, costing annually $165,308.50. These displaced 3,016 gas lamps, costing $52,780. The Common Council has requested that 2,093 additional electric lights be put in use, displacing 5,345 gas lamps. The cost of these electric lights will be $534,761.50 a year, while the gas lamps over the same area cost $93,537.50. Should the additional electric lights be authorized, there will be on Manhattan Island 2,740 electric lights, costing $700,070, and 13,685 gas lamps, costing $232,986.50. As the cost of lighting the Twenty-third and Twenty-fourth wards is $117,630, the entire cost of lighting the city would be $1,050,686.50. Mr. McCormick says that it would not be wise to remove the gas lamps in areas covered by electric lights, as there might be emergencies that would compel the city to use gas. He has not discovered any advantage that the electric light possesses except instantaneous lighting. The Gas Commission is now considering proposals from gas and electric light companies for lighting streets and public buildings for the ensuing year.

A Singular Tank Explosion.

A tank of half inch wrought iron, with cast iron heads an inch thick, used to heat water for a hundred horse power boiler in a Lynn shoe factory, recently exploded, blowing the top head through the roof of the one story boiler house, so that a piece fell through the roof of the factory, a four story building, 65 feet high. The tank was three feet in diameter and six feet long, and the piece of iron which came through the roof weighed twenty-six pounds, but no one was injured.

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The Falls of Niagara.

BY RICHARD A. PROCTOR.

I write these lines in view of the Falls of Niagara. The very room in which I am writing, though the walls of the house to which it belongs are of more than the usual strength, vibrates like the cabin of an ocean steamer. The roar of the mighty Horseshoe Cataract, combined with the more distant but distinguishable tones of the American Cataract, fills the air with resounding evidence of the might of gravity. *That* is with me the special influence of this stupendous natural phenomenon. It seems to speak to me of the energy of that force which alone, of all the forces known to man, seems to be the constant, ever-present attribute of every particle of matter. When I first saw Niagara from a great distance, the idea of solemn calm, which Dickens found most impressive even when close to the great cataract, forced itself on me as the chief and overruling idea suggested by the contemplation of the imposing spectacle presented here. Even then, however, the sense of constant increasing energy associated itself with the sense of calm and almost of rest. If two ideas so incongruous as rest and work can ever fill the mind simultaneously, it is when, as at Niagara, we see a force at work unceasingly. Restfully, though unrestingly—restfully, because so easily and steadfastly—the great cataract does its work. The consciousness that for thousands of years the same processes have been at work, cutting their way through the strata of the raised land separating Erie from Ontario, the thought that for thousands of years the work will continue, till at last the waters of Erie will find vent in a tremendous cataclysm by which the whole face of the region between Erie and Ontario will be altered, is suggestive of power so immense that its exercise year by year, day by day, minute by minute, seems, when compared with its totality, like rest rather than like work.

But close by the ever-rushing masses of water, especially by the shores of the Upper or of the Lower Rapids, one cannot escape the sense of energetic action—at least, I cannot, for my own part. The feeling comes on me that *here* one sees gravity at its work. Here is the mighty terrestrial energy which yet is but a sample on an exceedingly small scale of the energy which operates throughout all space, on suns as on planets, on systems of suns as on solar systems, on systems of such galaxies, and on higher and higher orders of systems absolutely without end. We recognize terrestrial gravity at its work here, however, only because it has here work to do on such a scale as to afford some idea of the real meaning of gravity, and yet within such compass that we can grasp the sense of the work that gravity is doing. And it is because, vast though the work is in one sense, it is so exceedingly minute in another, that the scene presented by Niagara is so impressive when rightly understood. Here gravity works on just so much of the waters of the great lake system between British North America and the United States as corresponds with the rainfall on the area whose drainage reaches Lakes Superior, Michigan, Huron, and Erie. The supply is intermittent, the outflow almost uniform. Very slight is the difference which a wet or a dry season makes in the waters of Niagara. But to think that the rainfall of this area, a downfall which seems locally insignificant, is here concentrated into such mighty masses of water! and, still more, to think that the gently-acting forces by which the waters of the sea are raised into the air in the form of cloud, and falling thence as rain (in which a portion of their energy of position is parted with), are here represented by forces acting with such resistless energy, such constant noise and turmoil!

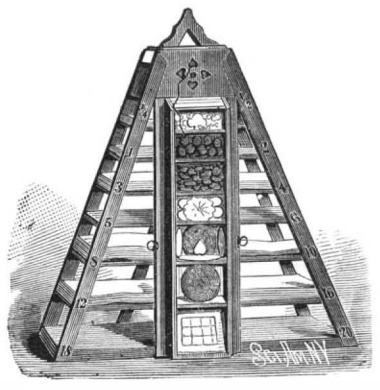
To the mere accident (in a sense) that the water raised from the seas has here fallen on upraised regions instead of on the lower levels, to the mere difference of height between the places on which they fall and the sea level from which the sun's heat raised them, we owe the tremendous forces represented by the Falls of Niagara and the Upper and Lower Rapids of this short but most active river. Nay, we may go further, and yet be far within the limits of Niagara's wonders. The clouds which float in the air over North America contain within them potential energies enormously exceeding all the forces at work here in Niagara, for they represent not alone the drainage of the Great Lake Valley, but of the whole area drained by the Missouri, the Mississippi, and the other mighty rivers of the continent. A small portion of these energies, finding its way along the Lake Valley to Niagara, is concentrated into the tremendous exhibition of force which is so impressive—nay, so appalling—to all who stay long enough near Niagara to apprehend rightly its significance.

Here, then, we have Niagara telling us of terrestrial gravity, not only by appealing to our senses of sight and sound in such sort as to overwhelm and confound us by its gathered energies, but also by appealing to our reason so as to assure us that "these are but a portion" of the great force of gravity; "they utter but a whisper of its might, the thunder of its power who can understand?" If, in drawing but a most minute fraction of the earth's rainfall through a few hundred feet (the Falls themselves are but 160 feet in height), the earth's gravity can present such impressive evidence of its might, what must we think of the whole energy even of terrestrial gravity? And terrestrial gravity is less than the three-hundredth part of Jupiter's gravity, less than three-hundred-thousandth part of the sun's gravity, while even the stupendous force of solar gravity is dwarfed almost into nothingness by comparison with the attractive might of Sirius, Vega, Altair, and others of that chief order of stars whose bluish-white light tells us of vastly superior mass, and, presumably, of relative youth, from what we know of the laws according to which greater and less masses have longer and shorter stages of cooling—that is, of life. Absolutely as nothing, in turn, is the energy of these compared with the inconceivable energy of the whole universe of suns.

We cannot follow step by step these tremendous progressions of force, or even take a single step along the road which leads to this infinity of might. We are appalled in contemplating them, even as one who stands on the verge of a tremendous abyss whose bottom is lost to his view feels giddy at the contemplation of depths into which he cannot advance even by a single step.—*Newcastle Weekly Chronicle.*

A NEW BAG RACK.

The engraving shows a rack adapted to hold a number of paper bags of different sizes, and also samples of groceries, a ball of twine, cards, etc. The form of the rack is clearly shown. It is made with one or two show-case attachments, and when two are used it is made to revolve. It has a receptacle for cord and two cases for cards, letters, etc. The show-cases are used to display samples of fancy crackers, dried fruits, and candies, and in addition to facilitating the sale of goods they save the merchant from the ravages of those friendly individuals who, at each visit to the store, help themselves to any uncovered eatables within reach. The pyramidal shape of the rack is completed by a perpetual calendar (not shown in the engraving) fastened on the lid of the twine box. The rack is neat and ornamental in appearance, compact, and its use presents all sizes of bags within easy reach of the clerk.



This invention has been patented by Mr. Robert E. Williams, corner of Commerce and Akard Streets, Dallas, Texas.

The Alcoholic Disease.

An examination of alcoholic intemperance in its origin can only terminate in one result—that is, in the conviction that it belongs, both physically and morally, to the class of fermentative or zymotic diseases. No mere deprivation of natural appetite will produce it; never does it exhibit itself till alcohol has been consumed; and what is especially to be remarked is, that alcohol acts in the prodution of the intemperate habit by poisoning the blood and arresting the healthy operation of the nervous system. It attacks the higher faculties; those qualities which give a moral tone, and lead man up to true happiness and a virtuous life. It dethrones reason, and retrogrades its victim to the level of the brute.

In this manner, and in no other, the craving for alcoholic drinks is produced—which is always a physical malady in its inception—until by continuous indulgence it takes a settled and chronic form, leading its victim through the stages of *mania a potu*, *dipsomania*, *epilepsy*, and numerous forms of mental and physical depravity.—*Quarterly Journal.*

How to Carry, Unaided, an Insensible Man.

The following method is adopted by and taught to the firemen of the London Fire Brigade:

A small platform, some forty or fifty feet high, has been erected on the roof of one of the buildings in the drill yard. One-half of the men who are drilling go up to this platform, and prostrate themselves in all kinds of peculiar attitudes, some on their backs, some on their faces, some on their sides, and some curled up. The other half have to go up and fetch them down single handed. The rescuing fireman first straightens out the seemingly lifeless body of his comrade, and rolls it over on to the face. Then, taking hold under each armpit, he raises the body on to his right knee, so that he can put his arm round the waist, and the arm of the insensible man round his own neck. Taking a firm hold, he suddenly straightens himself up, and walks away with his burden in an upright position, and the whole weight of the other's body supported and hooked, as it were, by the arm. He has then to carry his comrade through the window as best he can, and shoot him down the escape.

Ivy Lawns.

Our English agricultural contemporaries have had considerable to say lately on the above subject, but not until now have we seen any directions for preparing the soil for growing the ivy.

A writer in the *Farmers' Gazette* (Dublin) thinks it a wonder that ivy lawns have not hitherto been more generally adopted than they have, especially in soils where lawn grass refuses to grow, and in situations where it cannot properly be mown and kept neat and eye-sweet.

Instead, however, of pointing out the advantages of ivy lawns, or of sounding their well merited praises, I shall probably better fulfill the wishes and satisfy the longings of your interested readers by plainly, and as practically as possible, giving directions for making and maintaining them. A piece of ground to be seen from some desired spot is selected, which may either be level, sloping, convex, concave, or all combined, as nature has designed it. The ground is dug over to a depth of 12 inches, and in digging it care should be taken to either remove or bury all turf, roots, and stones nearer the surface than about a foot. The earth is also to be thoroughly broken and pulverized, and the surface made whatever it is designed to be in regard to shape and form. When the ground is all properly prepared and ready for planting, the plants are brought forward, which consist of the young shoots or tendrils of the common ivy, Hedera helix, which are best procured from walls, where the tendrils can be easily removed by the hand without breaking them. Shoots of one or two years' growth are preferable to that of older lived, as they grow more certainly and quicker.

The common garden line is now stretched along the surface of the prepared ground a few inches in from the outer edge, and if the ground in the direction of the line is undulating, the line must be pegged down with hooked pegs or other means. A notch is now made along the line with the garden spade in the same manner as if for planting potatoes, except that for ivy planting the notch is not so deep, being only from 4 to 5 inches. If the soil is a light loam, or abounds with sand, nothing further is required beyond laying the ivy tendrils in the trench, and covering them to the desired depth; but if, as frequently happens, the soil is either clayey or inert, a little sand should be strewn along the trench before the plants are put in, and again, after being laid, an inch deep or so should be put above them.

The most important part of the work, and that which requires most care and attention, is that of laying the tendrils along the notch, so that the greater portion of the leaves be kept above ground. The length of the leaf stalk, it will be observed, is that by which the depth of the notch has to be regulated. If long, the trench will require to be deep, and if short it will require to be shallow; and, indeed, as is found in practice, some parts of the notch must be one depth and some parts another, so as to suit the description of plant that is to fill it. The tendrils or shoots of the ivy are, as it were, strewn along the trench, overlapping each other a few inches at their junction, and the leaves, as already described, carefully kept above the surface of the ground when filled in, raked, and smoothed over.

The second and succeeding rows are planted and proceeded with the same as the first, and are about nine inches apart from center to center.

During the first and second season after planting, which is best done in April or about the beginning of May, the ground requires to be kept clean of weeds, the same as in nursery culture, after which, by reason of the broad leaf, close and dense foliage, weeds or grass scarcely ever come up.

All that is further required beyond what has already been described is that of annually clipping or mowing off the whole leaves nearly close to the surface of the ground. This should be done in May, as early in the month as convenient, which has the two-fold advantage of clearing off all the damaged and weather-beaten leaves, which the winter's severity commonly inflicts, and of allowing a fresh and new crop to come up and cover the ground quickly, both to afford summer and winter beauty. If the old foliage is cleared off at the beginning of May, the ground will be all recovered with the new soft and shining verdure by the first or second week of June.

We have probably no other evergreen ornamental plant at once so beautiful and accommodating as the common ivy, not only for forming lawns and covering walls, but the applications that can be made of it are almost innumerable, of some of which it may scarcely be said whether they are most ornamental or useful.

The Liquid of Fromherz.

The author has compared two tartaro-cupric liquids, the one prepared with potassa and the other with soda. The first was made up with 41·67 copper sulphate, potassium bitartrate 20·89, and caustic potassa 10·44 gms., made up with water to 1,000 c.c. It is of a fine sky blue, and acts in the known manner upon glucose. The sodic liquid—prepared in the same proportions with pure soda in place of potassa—has no action upon glucose. It is of an intense blue, less azure than the potassic liquid.—*E. J. Maumene.*

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ENGINEERING INVENTIONS.

A grate bar for furnaces has been patented by Mr. James Burrell, of Bristol, Somerset Co., England. The invention consists in a series of rotating shafts provided with plates or bars, and fitted to work between the fixed bars, so as to insure an absolutely clean fire surface, and thus promote combustion.

A dumping car has been patented by Mr. David H. Valentine, of Brooklyn, N. Y. The car is adapted for dumping directly from the truck in the ordinary way, or may be lifted from the truck and swung by a crane to a distance, and then loaded or dumped, the body of the car being readily separable from the truck.

A hand car has been patented by Mr. David H. Beach, of Litchfield, Conn. This invention covers a special construction and arrangement of parts for a portable hand car for railroads, for the use of superintendents and others, in which lightness shall be combined with adequate strength, and a high rate of speed be readily attainable.

A dust guard for car platforms has been patented by Mr. Luther B. Wood, of Omaha, Neb. A curtain is secured on a roller at the corner of the car, with a spring for winding, and other novel features, making a new and improved device for closing the ends of car platforms and excluding wind and dust, the guard being held within a casing within car when not in use.

A regulating valve has been patented by Mr. Ebenezer Hill, of South Norwalk, Conn. The cylinder has an outlet slot and concaved lug, the concaved side having an elastic metal plate with its edge within the outlet slot, so the width of the outlet slot can be regulated by adjusting a fastening bolt, making a simple mechanism for controlling throttle valves, operating air compressors, controlling dampers, etc.

A car coupling has been patented by Mr. James L. Griffin, of Cusseta, Tex. The drawheads have stationary hooks and recesses in their sides, and pivoted hooks held in places by springs, with trip plate and lever and chains and lever, so the cars will couple themselves when run together, can be readily uncoupled, will uncouple themselves when thrown from the track, and can be prevented from coupling when run together.

A spike extractor has been patented by Mr. Albert W. McCaslin, of Pittsburg, Pa. It has a pivoted claw bar, whereby the extractor may be applied to the head of the spike and fulcrumed upon the rail or upon the tie for drawing the spike, and it is so made that the operator can stand in the middle of the track and draw all the spikes on both sides of the rails, being especially useful in working through tunnels and narrow cuts.

A railroad switch has been patented by Mr. Abraham Ayres, of New Yorkcity. This invention consists in the combination, with the stationary frame and the rocking frame of a railroad switch, of a spring attached to one of the parts and pressing against the other, whereby the rebounding of the rocking frame after being rocked is prevented, the invention relating to switches operated by the weight of the horses drawing the cars.

A car coupling has been patented by Mr. Hugh Graham, of Dartmouth, Nova Scotia, Canada. The coupling pin has its lower end curved downward toward the rear, and the pin has on its front an offset or shoulder; from the pin a rod also projects upward, the upper part of the rod being squared and passing through a corresponding aperture in a guide arm, with other novel features, so when the link passes the pin the latter drops and couples the cars.

AGRICULTURAL INVENTIONS.

A check row corn planter has been patented by Mr. Darius M. Culver, of Tipton, Iowa. This invention covers a novel construction and arrangement of parts in a machine to facilitate the planting of corn in accurate check row, constituting a corn planter whose operation is easily controlled to do its work with great exactness.

A harvester reel has been patented by Mr. Frederick Laqua, of Thielmanton, Minn. The reel shaft is made in two parts connected by a sleeve permanently attached to one part and with the other part by a bolt, the object being to secure the delivery of the cut grain upon the apron of the harvester in proper direction to be taken to the binder.

A cultivator has been patented by Mr. Mark T. McGee, of Chipley, Ga. This invention provides means whereby the sulky and plows may be guided to run at an angle with or to one side of the path of the team, and also to hang the plows so that the desired pitch may be given to each one independently of the other, so any plow may be held out of service, and the depth of plowing regulated, etc.

MISCELLANEOUS INVENTIONS.

A vaginal syringe has been patented by Mr. Theodore Kern, of Kokomo, Ind. This invention covers a special construction and combination of parts by which it is intended first to close the vaginal canal, and then to lave or medicate the parts beyond the inclosure by the same device.

A seat attachment for vehicles has been patented by Mr. Frank A. Mackie, of Ocean Grove, N. J. Combined with a tricycle frame, directly over the steering wheel, is a baby seat, whereby a baby may be carried in view of the rider, and without affecting the balance of the machine.

A churn dasher has been patented by Mr. James F. Hale, of Stephenville, Texas. This invention relates to reciprocating churn dashers, concave on their under face, and covers certain special constructions of the several or main parts of such dasher, for giving improved effects to its action.

A fan has been patented by Mr. Max Rubin, of New York city. This invention relates to that class of fans that are closed by being drawn into a case, and opened by being withdrawn from the case, and has for its object to simplify the construction of such fans and promote certainty in their action.

A clasp for purses has been patented by Mr. Ernst P. Hinkel, of Offenbach-on-the-Main, Germany. It consists of a ball mounted loosely to turn and slide on a tube, a pin projecting from the ball through a slot in the tube, and within the tube a spiral spring, the device being a simple one with positive action.

A refrigerator has been patented by Mr. Washington I. Hall, of Chester, Orange Co., N. Y. This invention covers a special construction and arrangement of parts in a refrigerator to economize ice, promote convenience in use, and allow a more regular temperature to be maintained than is practicable with refrigerators of ordinary construction.

A toy spring gun has been patented by Mr. Francis W. Goodyear, of Springfield, Mass. Combined with the barrel is a slide, an elastic cord being secured to the slide and passed over pulleys at the muzzle end of the barrel, and over a trigger pivoted in the barrel at the butt end, making an improved toy pistol or gun for throwing darts, arrows, etc.

A street lamp has been patented by Mr. H. George Schuette, of Manitowoc, Wis. This invention relates to devices for raising and lowering oil lamps in lamp posts, to allow the lamp being brought down within the post to an opening near the ground, and covers certain improvements on former patented devices of the same inventor.

A chicken brooder has been patented by Mr. Frank Rosebrook, of Elmira, N. Y. It is more especially intended for nursing young fowls hatched in an incubator, combining therefor a special arrangement of casing with heating pipes and fresh air pipes, with strips of flannel or analogous fabric, intended to keep the chicks properly warm.

An expansion fastening for screws and bolts has been patented by Mr. Frederic H. Evans, of Brooklyn, N. Y. The expansion jaws are formed in one piece, with a solid annular base or connection, and expanded by a wedge nut drawn between the jaws by a bolt, so the jaws will not be liable to get out of place or separated.

An improved thill coupling has been patented by Mr. Joseph A. Robison, of Everest, Kan. This invention consists in the combination, with an axle clip having a screw threaded aperture, of a bolt having a loosely mounted tubular nut, making a strong and durable coupling, which cannot work loose, and in which the bolt is prevented from turning.

A box fastener has been patented by Mr. Henry Krog, Sr., of Washington, Mo. Combined with a box having loops or eyes on the top edges of its sides at the ends is a cover with loops on its side edges at the ends, with rods adapted to be passed through the loops or eyes on the box and cover, and thus lock the cover in place, to form a hinge for the cover.

A soil pulverizer and leveler has been patented by Mr. Absalom C. Funk, of Monticello, Ill. A frame is supported adjustably on wheels, and has at its forward part twisted knives to cut the soil into sods or strips and turn the strips, and at its rear end a steel plate to cut in pieces clods and shave off projecting parts of the soil, to rapidly and thoroughly pulverize and level the soil.

An earth scraper has been patented by Mr. William H. C. Goode, of Sidney, Ohio. The object is to prevent the handles, when the scraper is inverted, from being caught under the single trees, and for this purpose elastic instead of rigid stops are provided, so the elasticity of the stops shall cause a rocking or bouncing of the scraper, and thus facilitate the turning of its back upon its bottom with little effort.

A belt fastening has been patented by Mr. Samuel Bretzfield, of New York city. It is so made as to make belts conveniently adjustable for waists of any size, a plate being provided with studs and a slot, or a crosspiece forming a slot, one end of the belt being passed through the slot or under the crosspiece, and the studs passed through apertures in the end of the belt.

A two wheeled vehicle has been patented by Mr. Charles D. Adams, of Geneva, Ga. This invention consists in spring gear of novel construction and arrangement, so that a back spring absorbs the motion of the horse, and the suspension tugs of the seat being about midway between the springs, the motion of the seat will be vertical, and not affected by side jerks.

A folding reading desk has been patented by Mr. David D. Bowman, of Eureka, Cal. This invention covers a contrivance of a number of hinged leaves and jointed braces on the upper side and edges of a fixed central top of a pedestal, so that a number of books may be conveniently arranged, the pedestal allowing the desk to revolve freely, and the leaves being arranged to fold into the form of a simple plain table top.

A vehicle brake has been patented by Messrs. John L. McIntosh, Edward H. Bacon, and Theron Vail, of San Antonio, Tex. This invention consists in the attachment of the end of the friction band which connects directly to the shaft to an eccentric pin on the shaft, whereby the band is tightened on the friction drum with a vise-like grip when the brake is fully applied.

A saw mill set works has been patented by Mr. Benjamin E. Sergeant, of Greensborough, N. C. This invention covers a special construction and arrangement of parts designed to accurately and easily advance the log on the head block a definite distance for each cut, the feed mechanism being adapted to be disconnected to permit the knees to be quickly pushed back by direct pressure, thus saving much time.

A strap attaching device has been patented by Mr. John T. Shannon, of Carlisle, Ind. This invention consists of a peculiar form of hook plate having a side plate to which the strap is attached, the hook plate having one or more hooks which are adapted to receive the ring or other object, the device being more especially for use upon harness for attaching straps to rings, buckles, etc., without sewing the straps to the rings.

A flood and sluice gate has been patented by Mr. James S. Brown, of Eureka, Cal. It is vertically movable, having the central guide on one side and additional guides on the opposite side at its vertical edges, the bearing faces of the guides being parallel, in combination with inclined beams to guide the gate in its movement, the construction being such that the gate will not cramp in the ways, and can be easily raised and lowered.

A rain water escape has been patented by Mr. Orion De Kay Townsend, of Isle St. George, O. Combined with a rain water pipe is a hinged gate for closing the pipe or an opening in its side, and a water wheel arranged in the pipe and connected with the lever of the hinged gate, so the water that first flows down the pipe and washes off the roof is conducted out of the pipe, and then the side opening is closed automatically.

A process for refining oils and other hydrocarbons has been patented by Mr. Adolphe Rock, of Parral, Estado de Chihuahua, Mexico. It consists in treating them with lime or other alkaline earth and a body rich in oxygen and deoxidizable in the presence of the alkali, such as manganic and chromic combinations of potash, chromic acid, etc., the process being also applicable for the treatment of tallow, lard, rancid butter, and other solid hydrocarbons.

An electric burglar alarm has been patented by Messrs. John H. Hill, of Long Island City, N. Y., and Joseph E. Babcock, of New York city. The object of this invention is to reduce the resistance when the bell is being sounded, and also to keep the bell ringing if the circuit has been broken by closing the door or window that caused the sounding of the alarm, the armature of an electro-magnet being held in a spring, the tension of which is less than the force of the residual magnetism in the magnet.

Combined shafts and pole for vehicles form the subject of a patent issued to Mr. John Pettinger, of Carpenteria, Cal. A bent bar or hounds has saddles to receive the shafts and fastening springs and links to secure the shafts in place, a cross bar with sockets to receive the ends of the shafts, and the shafts pivoted in the sockets, so that, without being detached, they can be arranged at such distance from each other as to receive a horse between them, or close together to serve as a pole.

A knife for harvesting tobacco has been patented by Mr. Frederick Visscher, of Mount Sterling, Ky. This invention consists in forming a wedge at or near the juncture of the handle and cutting blade of a tobacco knife, so the wedge will engage and force its way into the pith of the stalk, to guide the knife in its descent and keep it from slipping sidewise from the stalk, and cause the split stalk to separate, so as to let the hand of the operator pass between the split stalk without touching it.

A combined heater and ventilator has been patented by Mr. Frank R. Henry, of Murfreesborough, Tenn. This invention relates to fireplace heaters for heating two adjoining rooms on the same floor with one fire, and is more particularly designed as an improvement on a former patented invention in this line, providing that the heat may be shut off from either room if desired, and also that either room may be simply ventilated; it is also intended, by heating one room direct, by the fire from the grate, and the other by radiation from the exposed fire back, to make the fire do double service, and utilize all the heat in the fuel.

NEW BOOKS AND PUBLICATIONS.

THE BOUND VOLUME OF "THE LOCOMOTIVE" for 1884 contains a very creditable amount of information. A series of papers on "Experiments upon Iron and Steel," by the editor, forms a prominent feature of the publication. This, with other articles *a propos* to steam boilers, will make the volume of much interest to both manufacturers and engineers. The selection of miscellaneous material has not always been so happy. The paper on aluminum is notably erroneous. It serves the good purpose, however, of bringing forth an entertaining criticism from Dr. Wahl, and of making the editors more cautious in the sequel. As an amusing result, a very sober article taken from *Van Nostrand's* is introduced with an editorial disclaimer of all responsibility.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Billings' Patent Adjustable Four and Six Inch Pocket Wrenches. Billings & Spencer Co., Hartford, Conn.

Blake's Belt Studs. The strongest and best fastening for Rubber and Leather Belt. Greene, Tweed & Co., N.Y.

Best Automatic Planer Knife Grinders. Pat. Face Plate Chucks. Am. Twist Drill Co., Meredith, N. H.

Volney W. Mason & Co., of Providence, R. I., have sent a number of their Friction Pulleys and Clutches for use in mines in Colorado and Montana.

Master Keyed Padlocks and Locks. Factory and Railway outfits. Miller Lock Works, Philadelphia, Pa.

Pat. Geared Scroll Chucks, with 3 pinions, are sold at same prices as common chucks by A. F. Cushman, Hartford, Conn.

Plain Milling Machine.—Length of table, 28 inches. Accompanying machine are wrenches, adjustable hangers, etc. Brown & Sharpe Mfg. Co., Box 469, Providence, R. I.

Cable Railway Grip Patent for sale. Address Wm. Gilday, 4052 Lancaster Ave., Philadelphia

Inventor.—Fast-selling household necessity that can be sent by mail, wants active partner. Small capital. F. K. Hickok, 2 West 14th St., New York.

For Sale.—No. 3 Merchants' Ammonia Freezing Machine. Price low. Address Theophilus M. Marc, 43 Exchange Place, N. Y.

Frick Company, Waynesboro, Pa., have for sale a heavy second-hand 18x36 engine. Send to them for prices and list of second-hand engines and boilers. All in good order. Prices low.

Wanted.—Second-hand Rowler Ore Crusher. Address, stating price, P. O. Box 521, Trenton, N. J.

The Philadelphia Exhaust Ventilator Co. desire correspondence with manufacturers of machinery and articles in their line, to handle as agents or as consignment. Particular information as to engines and motors desired. The Philadelphia Exhaust Ventilator Co., 121 North 4th Street, Philadelphia, Pa.

Wanted.—The New York Agency of a good machinery specialty. Address, with cuts, A. Rickard, 110 John Street, New York.

Patent for sale or on royalty for Batz's Hand Propeller, illustrated on page 197 SCIENTIFIC AMERICAN, of March 28, 1885. Address M. Batz, 357 Flatbush Ave., Brooklyn, N. Y.

Valuable Inventions for sale. J. Jarvis, Box 404, Toronto, Ontario.

Capitalists willing to undertake sorghum sugar culture (Collier's process). Address Wm. H. Hale, Albany, N. Y.

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Curtis Pressure Regulator and Steam Trap. See p. 285.

Woodwork'g Mach'y, Rollstone Mach. Co. Adv., p. 284.

Wood Working Machinery. Full line. Williamsport Machine Co., 110 W. 3d St., Williamsport, Pa., U. S. A.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Information requests on matters of personal rather than general interest, and requests for **Prompt Answers by Letter,** should be accompanied with remittance of $1 to $5, according to the subject, as we cannot be expected to perform such service without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Minerals sent for examination should be distinctly marked or labeled.

(1) G. W. J.—For 1 inch fall to a mile, the current will be ¾ of a mile per hour. For 16 inches fall, 3 miles per hour.

(2) A. C. asks if the 13th of May, 1847, was in the dark or light of the moon. A. The dark of the moon. New moon on the 14th of May, 1847.

(3) T. C. asks: 1. What is the best known application for the painless extracting of teeth? A. Nitrous oxide or laughing gas is probably the most satisfactory anæsthetic to use for dental purposes. 2. Ayers' formula for making sarsaparilla.

A. Fluid extract of sarsaparilla	3	ounces.
Fluid extract stillingia	3	"
Fluid extract yellow dock	2	"
Fluid extract May apple	2	"
Sugar	1	"
Potassium iodide	90	grains.
Iron iodide	10	"

Mix them.

(4) T. A. S. asks a few recipes for cheap dead white enamels or glazes, to run at a high heat. A. From our back files we take the following:

Cullet	11 lb.
Boracic acid	7 "
Sodium bicarbonate	4 oz.
Phosphate of lime	3 lb. 8 "
Oxide of antimony	2 "

See also article on "Enameling," in SCIENTIFIC AMERICAN SUPPLEMENT, No. 387.

(5) R. R. asks if there is any substance that is attracted to silver, or any instrument for determining its presence. A. We know of no such instrument, and no way of determining its presence except on examination or assay.

(6) C. W. F. desires a recipe for making hair grow on a bald head or beard on a smooth face. A. There is nothing that can make the hair grow when once the hair glands or roots become extinct, but frequently the growth of the hair can be stimulated and encouraged by various mixtures. See answers to queries No. 53 and 78 in SCIENTIFIC AMERICAN, for February 7, 1885.

(7) F. W. H.—Ordinary spring water does not generally contain animalcules. The water of running streams contains some animalcules; standing water in ponds and pools generally has more, and stagnant ponds and pools are usually filled with animalcules.

(8) R. W. F.—You should find on the lamp itself a memorandum of the number of volts required to run it. If you cannot get the information there, you should write the manufacturer, as a six candle power lamp might vary greatly as to the number of volts required to run it.

(9) C. W. McC. writes: Would you please inform me as to whether there is any substance except selenium which, when acted upon by light, will change that light into electricity? Is there any way to change that electricity back to light? A. We think you are mistaken in regard to the properties of selenium. Light merely changes its resistance to the passage of electricity. We know of no other substance that is affected by light to the same extent.

(10) F. I. P. writes: In regard to the Alaska's broken rudder, or a similar case, would it be practicable or possible, when the broken parts are made of metal, to use magnetism to bring and keep them together, until the injury could be fixed or some remedy substituted? A. We think not. It is extremely difficult to construct a temporary device of any kind which would be capable of resisting the action of the waves.

(11) J. R. W. writes: What size wire would you recommend for the primary and secondary coils of an induction coil to be one-half the size of the one described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 160? How many feet of tin foil surface would be needed for such a coil? A. Use No. 16 for primary and No. 36 for the secondary. You will probably require about 12 square feet of condenser.

(12) H. W. G.—Use whiting or rouge to polish your nickel plated bicycle.—The puzzle you ask us to solve is a simple one for children's amusement, but would take too much room to explain in these columns.

(13) W. H. asks: What is the cause of the isothermal of 60° extending farther north in the interior than on the western coast of the United States? A. The warm winds of the Pacific coast affecting the temperature on the regions north of the Rocky Mountains.

(14) A. S. H. asks for names of any cheap articles or chemicals procurable in a solid form and readily or quickly solvent in water, that will give water the following colors: 1, a transparent blood red; and 2, a transparent golden brown. A. You can procure from any dealer in chemicals, aniline colors soluble in water for such shades.

(15) E. H. B. writes: 1. I would like a receipt for removing shine from diagonal. A. We know of no way of effectually accomplishing this. 2. I would also like a receipt for making rubber stamps. A. See SUPPLEMENT, No. 83.

(16) M. S. desires a receipt for making varnish for drawings that will set (dry) in a short time. A. Try Canada balsam 1 ounce, spirits of turpentine 2 ounces; mix them together. Before this composition is applied the drawing or print should be sized with a solution of isinglass in water, and when dry apply the varnish with a camel's hair brush.

(17) N. W. writes: A person owning a house within 250 feet of which a railroad has been laid fears his house may be burned by sparks from locomotives. He has heard of fireproof paint and fireproof tarred gravel roofs. Are there any? Please state if there are any other fireproof roofs than metal and slate. A. There is probably no such thing as an absolutely fireproof paint, although some paints give a moderate degree of protection. The metal slating would be a far better protection.

(18) T. S. asks: What will keep celluloid collars and cuffs in their original whiteness? They turn yellow after being worn a short time. A. A preparation called celluline, made for this purpose, can be purchased from dealers in celluloid articles.

(19) H. H. writes: Could you give me the liquid process for etching on glass? Your process given in SUPPLEMENT, No. 313, cannot be used on stationary articles. The process of which I ask the formula is applied with a pen, and the etching is made without the article being heated. A. There is an article sold as diamond ink, prepared by dissolving ammonium fluoride in water and then mixing it with three times its weight of barium sulphate.

(20) W. E. McA. writes: What is the best material for a stern bearing of a tug boat? Boat has eighteen by eighteen inches engine, shaft 5 inches diameter, wheel 6 feet, and weighs about 1,800 pounds. Shaft has a composition sleeve on it, and runs in a hard composition box, and will only last one season. A. We think there is nothing better than phosphor bronze; possibly the journal bearing is too short.

(21) D. B. asks: How much water and how much land does the earth consist of? A. About ⅔ water, ⅓ land.

(22) J. F. writes: My pipe is one inch diameter, 1,000 feet long. Have a perpendicular head of 60 feet. What power can I get from cold water engine? A. One-tenth horse power.

(23) I. E. L.—You will find full information in "The India Rubber and Gutta Percha Industries, in the SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 249, 251, and 252.

(24) T. H. D. asks the commercial name of the acid used in cleaning steel or iron sheets, and in what proportion the acid and water are mixed; also if there is any danger in the use of it by the inhaling of the fumes. A. Hydrochloric acid 1 part, water 4 parts. No danger.

(25) L. P. O. asks the amount of expansion per lineal foot of brass, iron, and mercury, per degree of heat Fah. A. For 1 degree Fah.: Brass 100 feet expands 0·0125 inch. Iron 100 feet expands 0·008 inch. Mercury expands in bulk from 32° to 212° 0·015 = 1/66 of its bulk at 32°.

(26) J. G. M. writes: We are using white birch in considerable quantities cut into 6 inch by 12 inch lengths, the latter being the diameter of the round log, and find it almost impossible to prevent it rotting. Kindly inform us of any means whereby we can extract the sap so as to preserve the timber. We have tried drying, both by exposure to the sun and artificial means, and find this wood cracks or splits so as to be useless for our purpose. A. You can accomplish your purpose by boiling the wood in melted paraffine. The manipulation must be continued until all bubbling ceases, when the sap contained in the wood will be entirely replaced by paraffine, and all danger of rotting or cracking will be completely obviated.

(27) E. G. C. desires a formula or recipe for preparing waterproof or marine glue. A. Caoutchouc 1 ounce, genuine] asphaltum 2 ounces, benzol or naphtha q. s. The caoutchouc is first dissolved by digestion and occasional agitation, and the asphaltum gradually added. The solution should have about the consistence of molasses.

(28) J. H.—General Grant's case has been under the consultation of the most eminent specialists in the world, and everything possible in medical science to relieve his sufferings has been done for him. The use of cocaine for his difficulty was recognized in the early stages of the disease, and its application long continued.

(29) H. L.—We know of no institution that issues diplomas upon mere examination. You will have to go through a course of study in some technical institution; when, if found competent in the necessary branches, you may obtain a diploma. If you wish to obtain a license as a steam engineer only, you will have to apply to the local authorities where there are laws authorizing the license system, or to the United States inspectors of your district, who can issue license as an engineer on lake or river steamers.

(30) W. W.—The telescopes of surveying instruments, except in some special cases, are the same as the ordinary terrestrial telescopes or spy-glasses in their optical construction. It is necessary that the crosswires be put exactly in the focus of both object glass and eyepiece. Their magnifying power is from 10 to 25 times. Orifice at eye end three-sixteenths to one-quarter inch. Bright brass castings cost in New York 20 to 30 cents per pound, according to quality.

(31) P. D.—Creosote or kreosote is the oil of tar. It is made by distilling tar, and sold by all druggists. The effect of coal tar on the skin is due to the kreosote in the tar, and you should not use too much.—A "ringing engine" is an ordinary pile driver worked by a number of men lifting the ram a few feet, the main rope being spliced to a number of ropes at the end, so that each man has a separate end.

(32) C. H. writes: Please tell me how to prevent geared wind wheels from twisting edgeways to the wind. I have a 16 foot wheel with both journal boxes on main shaft in front of gear. Would it be better to place one behind pinion (which is in center of vane axis)? If not, why? A. Swing the guide wing or tail toward the edge of the mill that works to windward. The edging to windward is caused by the transmission of power if bevel gearing is used. Altering the position of boxes will not help. 2. Does burning bones destroy their virtue as a fertilizer? If so, how can I dissolve them cheaply? A. Do not burn bone for fertilizer. Grind or crush it fine. It requires no solvent.

(33) S. R. W.—The fire companies of New York clean their hose by fastening a small wooden box on the mouth of the nearest hydrant, partially open the hydrant, and pass the hose through the box. This cleans the hose as fast as the men can pull it through. This of course would not be sufficient care to take of leather hose, which occasionally requires frequent treatment with currier's stuffing.

(34) H. O. W. asks about the stamping and enameling of tin boxes. A. The stamping is done before the boxes are made up. The sheet tin is printed in the same manner as on paper, with varnish colors that are very tough. Special machinery is used in making the boxes, which preserves the printed figures from blemish.

(35) F. C. C. writes: I have a small upright boiler that does not make steam enough, and I would like to know if it would answer to put a coil of pipe around the inside of fire box, which is 14x10 inches, connecting at top and bottom, and can I use gasoline for making steam with, using two or three burners? Is there enough heat to reach top of flues, which will be eighteen inches from burners? A. You will have difficulty in putting a coil in the fire box that would materially add to the steam generating surface without encroaching upon the fire space. Better make a closure around the boiler with brick or sheet iron, and place the outlet to smoke pipe at the bottom. This will make the shell a heating surface. Crude petroleum is cheaper than gasoline under boilers, and is much used.

(36) A. B. D. asks if there is any way to granulate soft solder, similar to the granulated spelter sold in the trade. A. You can make solder into shot by pouring the solder through a sheet iron pan that is perforated with small holes, held several feet above a tub of water; at the same time shaking the pan a little to more perfectly break up the streams of flowing metal.

(37) M. A. W.—The economy of a generator should be indicated by the number of pounds of water evaporated under a given pressure per pound of coal. This ranges from 10 to 12 pounds in best boilers. The economy in horse power should be developed in the engine where from 20 to 30 pounds of water in steam, per hour, represents the range of present steam practice. It requires the same number of units of heat for generating steam, without regard to temperature of generating surfaces.

(38) E. E. F.—The drying of sapling timber is difficult under any circumstance. We recommend you to dry it in the bark, and in as long pieces as possible. Put it in a small drying room or steam box, and turn steam directly upon the wood, so as to heat it thoroughly. Keep steam on for one or two days. Then turn steam into the drying coil, and keep up the heat, with no open steam, in the drying room for a day, when you will find the sap thoroughly cooked and the wood without cracks. Then bark and cut.

(39) E. E. asks what to use and how to dye woolen cloth a dark brown. A. Work the goods for two hours at a boiling heat in 2 pounds of catechu. (The catechu is prepared by dissolving 1 pound of catechu in 7 or 8 gallons of boiling water; when complete solution is effected, add 2 ounces of copper sulphate, stir, and it is ready for use.) Then work at a boiling heat for an hour with 8 ounces potassium bichromate and 2 ounces tartar; next work for an hour in 2 pounds fustic and 8 ounces cudbear; wash and dry. For a deeper shade or a more chocolate hue, add 4 ounces logwood to the cudbear. See also the receipts given in SCIENTIFIC AMERICAN SUPPLEMENT, No. 163.

(40) F. J. K. asks a recipe for a harness polish of black, say of bluish tint. A. 4 ounces glue, 1½ pints vinegar, 2 ounces gum arabic, ½ pint black ink, 2 drachms isinglass. Break the glue in pieces, put it in a basin, and pour over it about a pint of the vinegar; let it stand until it becomes perfectly soft. Put the gum in another vessel, with the ink, till it is perfectly dissolved; melt the isinglass in as much water as will cover it, which may be easily done by placing the cup containing it near the fire about an hour before you want to use it. To mix them, pour the remaining vinegar with the softened glue into a sand pan upon a gentle fire, stirring it until it is perfectly dissolved, that it may not burn the bottom, being careful not to let it reach the boiling point—about 180° Fah. is the best heat. Next add the gum, let it arrive at about the same heat again; add the isinglass. Take from the fire, and pour it off for use. To use it, put as much as is required in a saucer; heat it sufficiently to make it fluid, and apply a thin coat with a piece of dry sponge; if the article is dried quickly, either in the sun or by fire, it will have the better polish.

(41) C. D. N.—On a perfect track the only difference between the draught of a small and a large wheel is the amount of friction on the axle divided by the semi-diameter of the wheels; which makes a very small difference of draught in favor of the large wheel. On a soft road this small difference is increased by the greater depression of the smaller wheel into the road surface for equal loads; which brings the leverage to bear slightly in favor of the large wheel. The distance of the horse from the axle also has a slight bearing upon the size of the wheel. The angle of the draught being greater for the small wheels tends to lift the forward wheels from the ground and thereby lesssen their traction. The greater distance of the horse from the wheels lessens this angle, and thereby slightly increases the traction. With wheels having a semi-diameter equal to the height of the hame hook, there can be no difference theoretically in the draught, whether the traces are long or short. Other points in the rig may make a difference.

(42) F. W. D. asks the meaning of "cut-off" in a steam engine. A. Cut-off may mean the appliance by which the engine is regulated, or may apply to the style of engine; or in connection with the part of the stroke at which the cut-off of steam takes place.

(43) H. E. asks: What preparation is used in making good grafting wax? A. Take 4 ounces pitch, 4 ounces resin, 2 ounces hog's lard, and 2 ounces beeswax; put them all together into a pipkin, and dissolve them over a slow fire, and it will form an excellent grafting wax.

(44) N. W. writes: Being 100 feet from a 20 ton manure heap and 500 feet from a cemetery, how deep should one sink a drilled or bored well to be sure of pure water? Is water freed from sewage impurities by boiling? How long will water stand in an open barrel in summer without deteriorating? A. This depends entirely upon what direction the subterranean water channel is running. In case the general drainage of the district is toward the well, it should be so sunk and incased as to avoid the nuisance and to meet a deep water stratum, and too much care cannot be used under such circumstances. Contaminated water is improved by boiling, which destroys the living sources of danger (the microbes). In a clean oak barrel, water for drinking should be renewed every day, if open to the air. If the barrel is bunged tight, the water will be good for several days.

(45) E. E. W.—Water in an inverted siphon as you describe will seek an exact level when not under motion as in discharging a stream. It will deliver a stream at any point below the level, in quantity governed by the friction of the water in the pipe and area of aperture.

(46) M. B. B.—We have seen a glass boiler and engine, the result of much labor and the genius of a professional glass blower. It was practically a failure. We could not give encouraging advice for a successful construction. It is safe not to do it.

(47) H. G. S. writes: What dimensions ought the steam ports to have of a cylinder of 6 inches stroke and 3½ inches bore? How much lap and lead and what throw must the eccentric have? Of what diameter should the crank shaft be? Are the dimensions of the cylinder proportioned right, and what power will it have with 80 pounds of steam? A. For your engine, make the steam ports ⅝ x 2½ inches; exhaust port ¾ x 2½ inches; 21/64 inch lap, ⅛ inch lead, 1 inch throw, 1¼ inch crank shaft; proportions of cylinder good. At a speed of 100 revolutions per minute you will have about 2 horse power.

(48) T. M. W. writes: I want to know how to rid water of oil when water is condensed from the exhaust. The engine is a 40 horse power Westinghouse, and the water is furnished by two wells, but in the dry season the wells fail, and we propose running the exhaust into large sheet iron or tin vessels, to condense the steam and use water over again. Would the experiment be likely to pay? Will it do to turn the exhaust into the wells to condense it? Would the oil be likely to give trouble in the boiler if the water is not freed from it before using over again? A. Do not put the exhaust into the well under any plea. You can make an air condenser of iron pipe or even of sheet iron or of light galvanized sheet iron pipe, shaded from the sun and exposed to a free circulation of air. Catch the condensed drip in a tank to settle, and skim off the oil. No oil should enter the boiler. It makes cake with the scale, and will settle on the shell, causing a burn. We think that it will be economy to build large cisterns to hold water to be used only when the wells fail.

(49) W. D.—Ice does not sink, but by the action of the warmth of the sun in spring it crystallizes in smaller needles and separates, floating until dissolved. The crystals being small cannot be seen from a distance, thus making the impression that it has sunk.

(50) W. M. B. asks (1) for good receipt walnut stain. A. Mix dragon's blood and lampblack in methylated spirits till you get the color required, and rub it well into the grain of the wood. 2. How can I color glue size like walnut stain. The stain I buy in cans won't mix with the size. A. Take one gallon very thin sized shellac; add 1 pound dry burnt umber, 1 pound dry burnt sienna, and ¼ pound lampblack. Put these articles into a jug, and shake frequently until they are mixed. Apply one coat with a brush. When the work is dry, rub down with fine paper, and apply one coat of shellac or cheap varnish. 3. How can I give pine a beautiful mahogany or lively reddish color? A. Boil ½ pound madder and 2 ounces logwood chips in 1 gallon water, and brush well over while hot. When dry, go over with pearl ash solution, 2 drachms to the quart. By using it strong or weak, the color can be varied at pleasure.

(51) F. C. writes: I have been told that the stems which cigar makers get in stripping Havana tobacco are subjected to a treatment that yields a product containing much of the flavor and aroma of that tobacco, and which is beneficially used on what is called "seed," tobacco for cheaper goods. Can you, and if so will you, inform me what that treatment is? A. An extract of tobacco is made by taking one pound tobacco, generally leaves, 2 pounds spirits (sp. gr. 0·900); digest them in a warm place for some days, express strongly, and again digest in a mixture of 1 pound each of water and spirit (0·900) for twenty-four hours; again press out the liquor, and evaporate the strained and mixed liquors in a vapor bath at a temperature not exceeding 167° Fah. (75° C.). We see no reason why the foregoing process cannot be applied to the stems referred to by you, although we doubt the general use of stems as you suggest, for they can be more readily made into cheap snuff.

(52) A reader asks how to make paste that will keep in warm weather, and what kind of machinery is necessary, and how to make paste in ten bar-

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rel lots. A. The addition of a slight quantity of carbolic acid to the paste will prevent it from decomposing during the warm weather. No special machinery is necessary for the preparation of paste. A large caldron and suitable arrangements for heating, a steam pipe being preferable, are all that is essential.

(53) R. S. asks whether the plant Caltha palustris, grows here in the United States. A. It does; and its proper name according to Gray's Manual is marsh marigold, although frequently designated simply as cowslip. 2. Also a recipe of a good indelible ink—a simple recipe. A. Use the following: 2 parts silver nitrate, 4 parts distilled water, 2½ parts gum arabic, 3 parts soda carbonate crystals, 5 parts liquid ammonia. Dissolve the silver salts in the ammonia, and the gum arabic and soda in the distilled water. The two solutions are then mixed together and slightly warmed, when the whole mixture becomes brown.

(54) J. H. D. writes: 1. Are the Brush form of armature and arrangement of magnets and commutators equal to the Siemens? They seem more simple. A. The Brush form of machine is very economical and efficient. 2. Why do you not advise small Brush machines to be made by amateurs? Is the armature too hard to make? A. It is a little more difficult to construct. Brush has patented an armature similar to the one suggested by you. It would undoubtedly hold together. 3. Is the Gulcher form of pole piece better than the Brush? A. We think not. 4. Please give law and formulæ of magnetic saturation. A. The maximum current that should be used is a current but little in excess of that for which the magnetism is nearly proportional to the current. 5. Please give formulæ for constructing armatures, so I can tell (at certain speed) what quantity and intensity of current it will give in a proper magnetic field. A. There is no formula for this. 6. What No. of wire should be wound on Trouve's electric motor shown in SUPPLEMENT, No 259, on field magnet and armature? A. It depends entirely on the kind of current you propose using. 7. Is there any advantage of placing field magnets in shunt circuit? If so, what proportion should shunt resistance bear to current? A. A shut wound dynamo is not liable to injury by short circuiting. The resistance of the shunt bears a certain relation to the resistance of the external circuit, and is generally determined by experiment. 8. In what number of the SUPPLEMENT do you publish a description of Siemens' later machines? A. In several numbers. See catalogue.

(55) E. N.—The problem of which you ask solution is an old "catch" question for beginners in algebra, and can only be done by "substitution." We have not room to give the work, but $x=3$ and $y=2$.

(56) A. A. S. asks: 1. Should a telegraph wire one mile long be inclosed in a heavy glass tube? Would it have any effect on the wire in the transmission of messages? A. It might prevent a very slight escape of electricity to the air, and it would probably increase the static charge in the line. 2. If a plate of glass, say 1 inch thick, 5x8 feet, be placed three feet underground, will extreme cold or warm weather affect it in any way? A. At that distance, yes. To reach a stratum of uniform temperature you would be obliged to go much deeper than three feet.

(57) E. R.—We do not think that the English police are all supplied with electric dark lanterns. It is possible that some of them are provided with such lanterns. The lantern is the invention of M. Grouve. We believe it is not for sale in this country.

(58) M. E. asks the cheapest way to bring water to factory from well three-fourths of a mile distant; the water is sometimes four and sometimes eight feet from top of ground; the factory is probably six feet below the top of the well; steam power at factory, none at well. Can we not lay iron pipe, and draw the water to us with an air chamber pump? How much water can we draw this way through an inch diameter (inside) pipe, also inch and a half pipe? A. 1 inch pipe will be useless for a suction pipe for so great a distance; 1½ inch pipe would yield about 1 cubic foot or 7½ gallons per minute, on a 4,000 foot suction with pump at factory; 2 inch pipe would double the volume.

(59) A. J. H. & Co. write: We are using a compound of white glue, refined glycerine, acetic acid, with gamboge for coloring, to form a material for "tableting" stationery and paper. Though very flexible at first it gradually dries hard, and loses its elasticity. Please give us a recipe that will retain elasticity. We do not wish a rubber compound, on account of danger, cost, or objectionable smell of the rubber solvents. A. The makers of the most widely used compound for this purpose keep secret the details of its preparation. We should think your compound a good one, and that possibly you might overcome your trouble by using a trifle more glycerine, or a slightly different kind or treatment of glue.

(60) B. B. writes: The citizens of our town wish to run water pipes, to be used in case of fire, from one end of the town to the other, about three-eighths of a mile. At each end of town is a mill with about a fifty horse power boiler each, and we have thought at said places to have a pump connected with pipe running through streets, with valves and hose connections at proper places. Is the plan a feasible one? If so, please be so kind as to tell us what size pump, pipe, etc. Will use salt water, and have to draw it about one hundred feet. A. For your fire apparatus use a 6 inch cast iron main pipe with hydrants at convenient places. A fire pump with steam cylinder 14x16, costing about $550. A pump at each mill would be worth its cost as an additional means of safety.

(61) A. L. M. writes: I have a engine 2¼ inches by 4 inches. How much power would such engine develop at 400 revolutions per minute, with 80 pounds of steam? What size vertical boiler will it take to supply the above engine? What diameter, height, number of flues, and size of flues? What thickness will shell and flue sheet be? How many feet of heating surface in such boiler? A. Your engine will develop 2¼ horse power. You will require 30 square feet effective heating surface in boiler. Boiler 2 feet diameter, 3½ feet high. Fire box 20 inches diameter, 15 inches high, 32 tubes 1¼, shell ¼ inch, heads five-sixteenths.

(62) D. W. B. writes: I want to cover my roof with copper or tin. Which will be the cheapest and best? A. There is a large difference in cost in favor of tin. Cistern water from a copper roof is not fit for drinking or cooking; otherwise copper will last 50 to 100 years.

(63) G. D. writes: I have different articles of zinc which are to be colored through dipping in a solution. So far I have tried chloride of antimony; it produces a nice black coating on zinc, but the solution soon becomes weak, and too expensive for the purpose. Have also used a solution of anvil dust, sulphur, arsenic, and muriatic acid; this makes a nice brownish bronze color, is cheap, and will do very well, but as I do not know the proportions of the different ingredients, find it difficult to get the same color, and to work well every time. A. We know of no cheaper way for making good work than the chloride of antimony process that you name. By making a record of the exact proportions by weight of your own cheap process, you may always secure the same color. Haphazard work never gives uniform results in chemical operations as well as in business operations.

(64) J. D. G.—For the breaking stress of white pine timber and joist: Rule.—Multiply the square of the depth by the breadth in inches; and this product by the coefficient 10,840. Divide the last product by the length between bearings in feet multiplied by the depth in inches. The quotient is the breaking weight in pounds.

For the	3″x12″x13 ft. beam..	30,018 lb.
" "	4″x14″x13 ft. "	46,690 "
" "	8″x 8″x13 ft. "	53,366 "
" "	10″x10″x13 ft. "	83,384 "
" "	12″x12″x13 ft. "	120,073 "

etc. Safe load about one-tenth of the above.

(65) E. C. desires the best receipt for preserving asparagus; if possible, the method used by the German (Erfurst and Lubeck) canning establishments. A. Cook the vegetables in the usual way in a glass jar if convenient, and when sufficiently cooked hermetically seal in precisely the same way as ordinary preserved fruit, etc., is treated.

(66) J. R. writes: I have 50 gallons grape wine made last fall that is imperfectly fermented. It worked all right for about two weeks, then became still and remains cloudy. What shall I do to induce fermentation? A. If keeping the temperature between 70° and 80° Fah. is not sufficient to induce complete fermentation, add a small quantity of yeast, previously well mixed with some of the liquor, and gently stir in.

(67) L. C. P. asks a formula for a plating (electro) solution, using phosphor-bronze for anodes. A. We do not understand how it can be possible to electrolytically deposit phosphor-bronze. The result of the action of the current would be the decomposition of the alloy.

(68) W. E. H.—We think you could not do not better than to study what has been done in the line of your inquiry. You will find in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 54, 380, 425, 437, very interesting illustrated articles on incubators.

(69) G. B.—The simplest galvanic battery consists of a plate of copper and a plate of zinc immersed in dilute sulphuric acid, one part of acid to ten of water. It would be well to amalgamate the zinc by rubbing on it a little mercury after it has been plunged in the acidulated water. For description of other forms of battery consult SUPPLEMENT Nos. 157, 158, 159.

(70) W. J. K.—The medical induction coil does not differ materially from any other. You will find a full description of the induction coil in SUPPLEMENT, No. 160. For medical purposes you should make the coil about three inches in length, an inch and a quarter in diameter, using four layers of No. 24 wire for the primary and about ten or twelve layers of No. 36 wire for the secondary. You will need no condenser. By arranging the bundle of wires so that they may be withdrawn from the coil or inserted therein, you will be able to regulate the secondary current.

(71) C. A. A. writes: Supposing we have a dynamo and circuit complete, with fifteen arc lights in the circuit, now I contend that the last lamp in the circuit produces light at the same instant that the first one does. Am I correct or not? A. The current is supposed to be equal throughout all parts of the circuit, and if the lamps are adjusted exactly alike and the carbons are all under the same conditions, the lamps should all produce a light at the same instant.

(72) M. H.—To succeed in making music by rubbing the rims of partly filled goblets, try wetting your fingers with a little turpentine occasionally.

(73) J. F. R. says: I have some nuts for carriage axles to polish: they are plated with brass to imitate gold; how are those finished, and what is used, They have a smooth, shiny appearance and not show any scratches from the buff wheel. There are felt wheels in the market. Are they any good, or are they no better than a wooden wheel covered with leather? A. Use a felt buff and crocus; or if a fine polish is required, finish with a cotton wheel and rouge.

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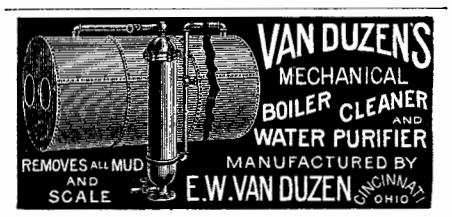

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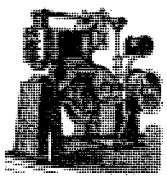

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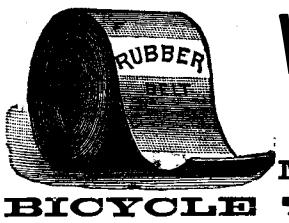

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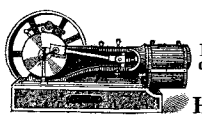

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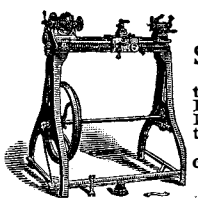

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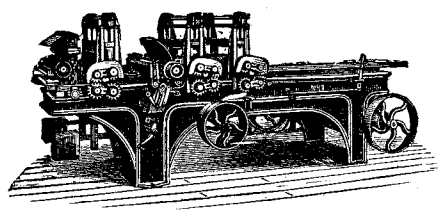

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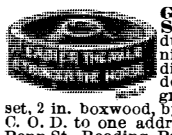

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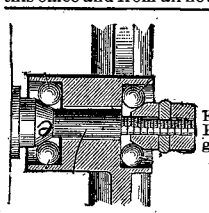

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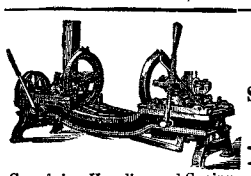

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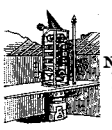

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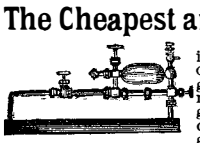

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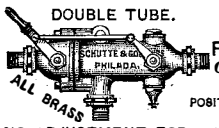

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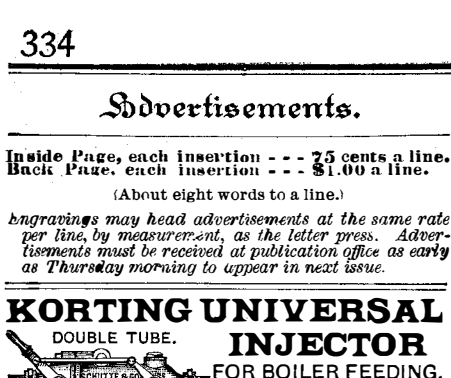

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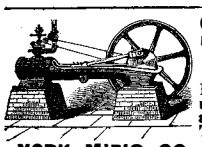

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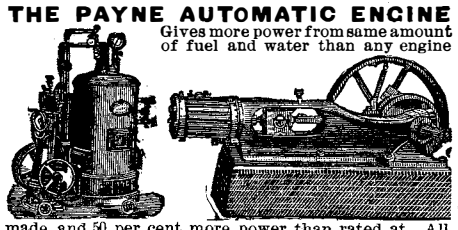

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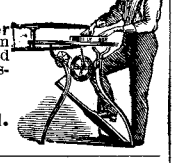

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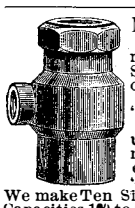

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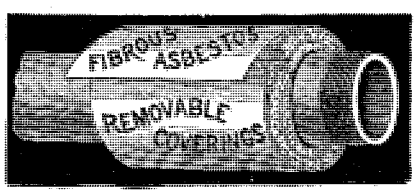

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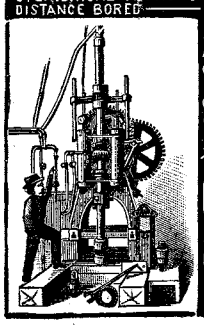

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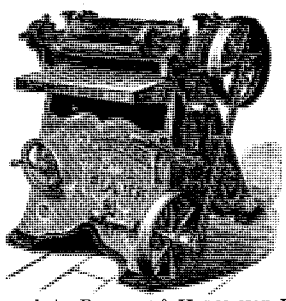

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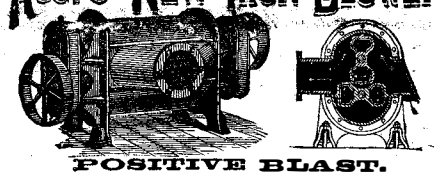

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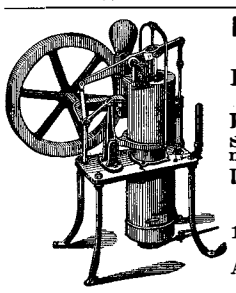

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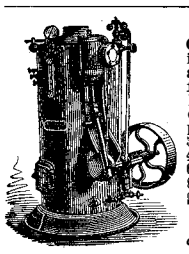

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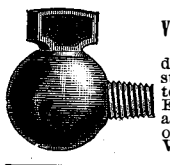

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